

December, 1931

Railway Engineering and Maintenance

a Merry Christmas



The National Lock Washer Company 48 German Street Newark, New Jersey

December, 1931

1932 straight ahead..Merry Xmas and a Happy New Year to all



RAILROADS make shipping and travel more attractive to the public by constant improvement in facilities and equipment.

HY-CROME spring washers have had a definite part in this program as it relates to maintenance of way materials.

You are facing a New Year and we trust it will be most prosperous. Our organization is at your service to help you effect economy efficiently through HY-CROME dependability.

We appreciate the business we have enjoyed and pledge our best efforts to continue to merit the confidence placed in our product and service.

RELIANCE DIVISION Massillon, Ohio

THE EATON AXLE & SPRING CO.
New York, Cleveland, Chicago, Detroit, St. Louis,
San Francisco and Montreal



HY-CROME

Reg. U. S. Pat. Office

MONEY SAVING TIE PLATES



FOR 1932 ECONOMY BUDGETS

IN THIS age of tie conservation, the Lundie Tie Plate is, without doubt, a necessity. It costs less to use than to do without. The Lundie Plate is a proven economic device which pays for itself over and over again by protecting ties against mechanical wear and prolonging their life in track. These economies are not limited to the year of purchase but extend through all future years. The economies keep on multiplying.

The outstanding Lundie feature is the design of the bottom. The complete elimination of sharp tie destroying projections assures 100 per cent service from treated ties.

Be sure to specify the Lundie Tie Plate in your 1932 budget.

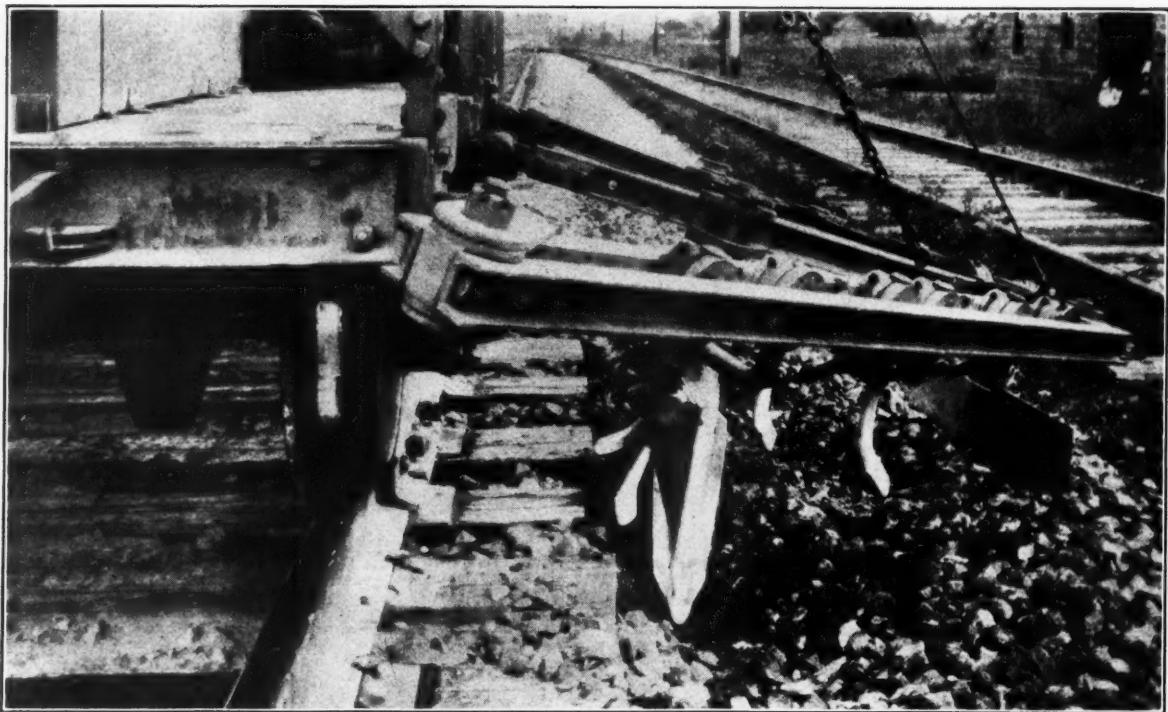
The Lundie Engineering Corporation

285 Madison Avenue, New York
59 East Van Buren Street, Chicago

LUNDIE

TIE PLATE

NEW FAIRMONT



WHAT YOU WANT TO KNOW ABOUT

... the New "Rooter"

A new appliance that was developed for quick coverage of water-bound track with hard-packed, badly cemented rock ballast shoulders. Consists of (1) large plow which easily "roots up" the hardest shoulder; (2) three scarifiers or smaller prongs which break up the large chunks; and (3) an undercutter which reaches in under end of ties and drains the wet pockets. All five points are manganese steel and replaceable.

In tests, 3 to 5 trips were found sufficient to break up and thoroughly agitate the caked rock, leaving shoulders formed to standard contour. Process can be followed by discing—but good results have been attained by using the shaper following the rooter.

... the 4 New Discs

We can now supply *four different sizes* of discs instead of the single size of 16" on first machines.

The 16" size is best, of course, for weeding and shallow dressing of shoulder where ballast is clean, and it is not desirable to bring up dirt from the roadbed. However, in cases of deep drainage of water-bound track with fouled shoulders, the 22" size is recommended. The 18" and 20" discs fit conditions that lie between.

... the New Grader

Grader blades of varying lengths can be supplied as desired. The smoothly curved blade rolls the material being handled toward the outer end, when so set. But blade is adjustable in four different ways to perform following described operations:

Skeletonized Track. Moves shoulder away from ties. Then moves cribbing dump (ballast picked and shoveled by hand labor from between ties and thrown outside ends of ties) also out of way so ties needing renewal can be easily pulled out and replaced by new ones. Then grades ballast back to ties, leaving shoulder formed to standard contour.

The grader serves equally well for moving out and replacing old ballast, or for wasting old ballast over the roadbed shoulder and grading new ballast dumped from cars.

REMEMBER

—Over Half the Railway Cars
Now in Service are
FAIRMONT PRODUCTS

THE RAILROAD WORLD

ATTACHMENTS

Radically Lower Cost of Discing and Drainage Operations

If you're trying to cut Maintenance expense—and who isn't!—get the facts about the three new Fairmont Work Appliances. The savings they bring are nothing short of sensational—just note the figures given below for representative work on average track.

No other piece of work equipment now in existence does as complete and effective

a job as does a Fairmont Discer equipped with the new "Rooter" (combination Ballast Plow, Scarifier and Undercutter), the Grader, and any of the four sizes of Discs required. They attach to your present Fairmont machine or may be had in any stated combination with the new Fairmont Discer. Let us send you complete data and illustrated bulletin. Write—

What YOU SAVE per MILE

DISCING

Fairmont Discer does it for \$1.05 to \$1.64 per mile (labor, gasoline, lubricants)—and does a better job. Railroad officials say that equal grade of work done by hand would cost approximately \$20 per mile.

BREAKING UP and DRAINING Rock Ballasted Track

Cost with Fairmont Discer equipped with "Rooter" averaged \$8.50 per mile over period of weeks (including labor, gasoline, oil plus time on siding while clearing traffic without interruption of schedules).

Cost of equal grade work by pick and shovel squad was \$161 per mile, nearly 19 times more!

A NEW AND IMPROVED FAIRMONT DISCER

Ample power and compressed air control of appliances result in high road speed—and the utilization of several appliances in combination, thus cutting down number of trips necessary.

FAIRMONT RAILWAY MOTORS, INC.

FAIRMONT, MINNESOTA, U. S. A.

General Sales Offices: 1356 Railway Exchange Building, CHICAGO

District Sales Offices:

New York City

Washington, D. C.

St. Louis

San Francisco

FAIRMONT RAILWAY MOTORS, Ltd., Toronto, Canada

Foreign Representative: THE BALDWIN LOCOMOTIVE WORKS

Manufacturers of section motor cars, inspection motor cars, gang and power cars, weed burners, mowers, ballast discs, ball and roller bearing engines, push cars and trailers, roller axle bearings, wheels, axles and safety appliances



K N O W S F A I R M O N T

ELECTRICITY IS THE MODERN POWER

SYNTRON

Motorless

ELECTRIC TIE TAMPER

2-TOOL OUTFIT

FOR SPOT SURFACING WITH A SMALL CREW

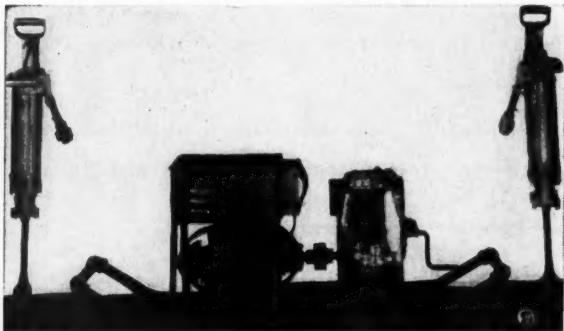
The power plant is small and light. It can be dragged along on its sled-like frame or picked up by two men and carried or rolled along one rail, wheelbarrow-like.

Complete Outfit Consists of:

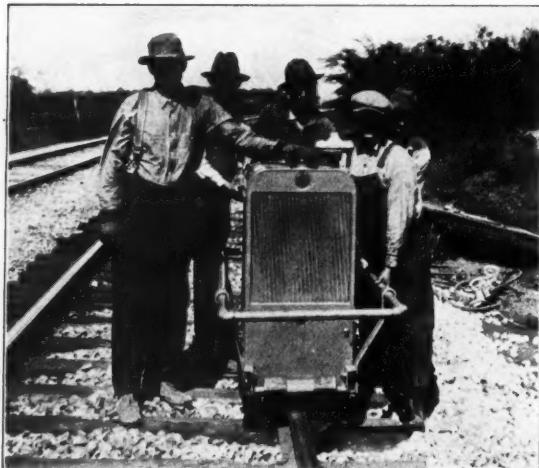
- Model P-3 Power Plant. (Weight 300 lbs.)
- 2 Tamers with Bars.
- 2 Tamper Extension Cables.

Specifications:

Engine: Single Cylinder, 3 H. P.; Air Cooled.
Generator: 3 K.V.A. Self-excited.
110 Volts, 25 Cycle, 2-Phase A.C.



Small Portable 3 KVA Power Plant, Weighing 300 pounds and Capable of operating Two Tie Tampers



Five Men Moving a Larger Outfit Power Plant. Note the Rollers

4-TOOL OUTFIT

IDEAL EQUIPMENT FOR A SMALL SURFACING GANG

The power unit is exceptionally small and light in weight.

Complete Outfit Consists of:

- Model P-7½ Power Plant. (Weight, 800 lbs.)
- 4 Tamers with Bars.
- 2-250 Ft. Cables (each cable operates 2 tampers).

Specifications:

Engine: 4 Cylinder, 17 H. P.
Water Cooled, Pump Circulation.
Force Feed Lubrication.
Generator: 7½ K.V.A. A.C.
110 Volt, 25 Cycle, 2-Phase.

This 4-Tool Power Plant will also operate 2 Nutters or 2 Rail Drills or 2 Screw Spike Drivers and many other portable electric tools including grinders, drills, saws, etc.

With the present curtailment in forces and working hours Electric Tamers are essential to track maintenance. The small size and portability of the power plants enable their use with reduced forces and the power and speed of the tampers will make up, in tracks surfaced, the loss in manpower.

SYNTRON CO.

Pittsburgh, Pa.

THESE FEATURES are worth more!

No other shovel, crane or dragline offers the railroad man as many money-making, time-saving advantages as the Northwest.

To equal a Northwest every other manufacturer would have to add the "feather-touch" control, the helical gear drive, a steering device that assures positive traction on both crawlers even while turning, a forged steel center pin, a slow speed, heavy duty power plant, and many other valuable features.

These features are worth more! They are the reasons why 42% of the crawler machines on American Railways are Northwests.

Ask what they mean to you!

NORTHWEST ENGINEERING CO.

The world's largest exclusive builders of gasoline, oil burning and electric powered shovels, cranes and draglines

1713 Steger Building
28 East Jackson Boulevard
Chicago, Ill., U. S. A.

The Patented Crawler Base that gives positive traction even while turning.

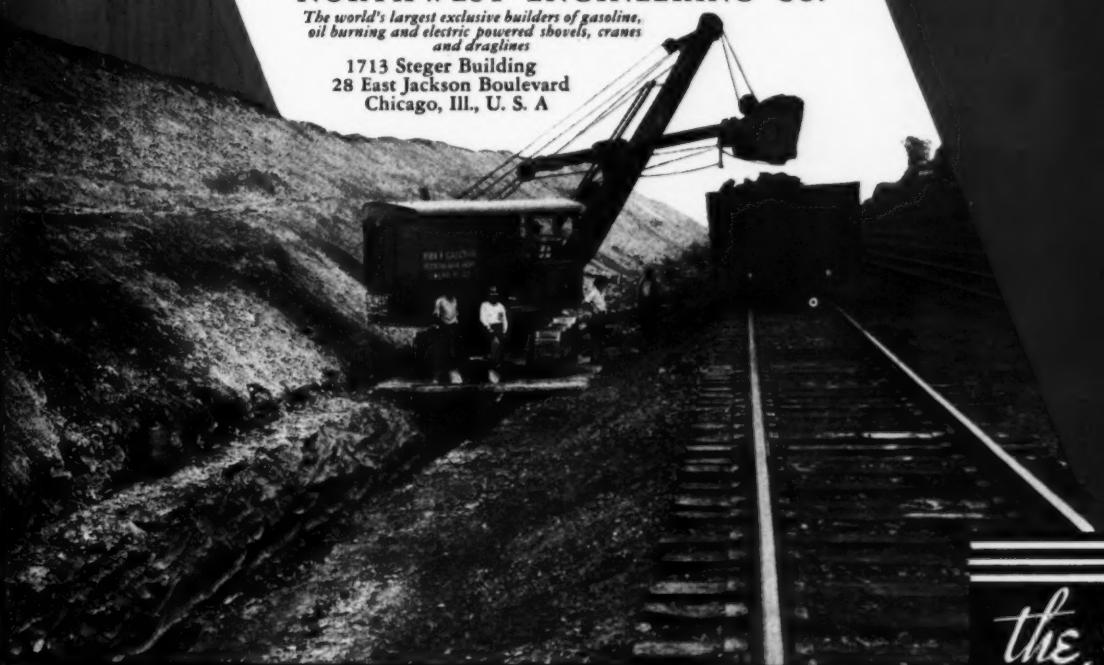
The "feather-touch" clutch control.

The helical gear drive.

Slow speed power plants on spring mountings.

Ball or roller bearings on all high speed shafts.

A forged steel center pin that takes the strains off the travel shaft.



NORTHWEST

REM 12 Gray

*the STANDARD
by which
SHOVELS
AND CRANES
ARE MEASURED*

on any job



XWELDING

Saves Money

STRIKING economies which oxy-acetylene welding effects in the repair of large or expensive castings are no more remarkable than the smaller but equally important day-by-day savings it makes on hundreds of repair, maintenance, and production jobs.

Oxwelding saves time and money wherever strong dependable joints are required in metal. The oxy-acetylene process is an important ally in any railroad's war on expense.

The Oxweld Railroad Service Company, qualified by nineteen years' experience in supervising railroad welding and cutting, teaches railroad employees the best methods of welding and cutting, assists them in their work, and supplies them with the best materials and facilities.

Year after year, the majority of Class I railroads find this service of increasing value.



THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation



NEW YORK, Carbide and Carbon Building

CHICAGO, Carbide and Carbon Building

"STEAD" *TRUE TEMPER RAIL ANCHOR*

Clamp and key are now shipped assembled which facilitates handling and simplifies application.

Initial and Application Costs Low



THE AMERICAN FORK & HOE COMPANY

General Offices: Cleveland, O.

Factory: North Girard, Pa.

District Offices

253 Broadway, New York, N. Y.—Daily News Plaza, Chicago, Ill.

Representatives at

Boston, Denver, Detroit, Louisville, Minneapolis, St. Louis and San Francisco

Foreign Representatives

Wosham, Inc., 44 Whitehall St., New York, N. Y., and 60-72 Windsor House, Victoria St., London, S.W.1

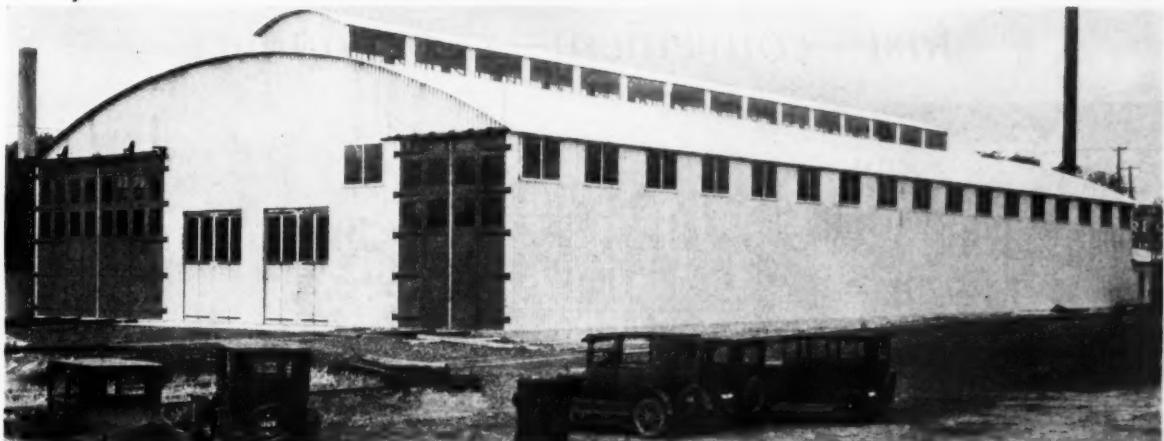
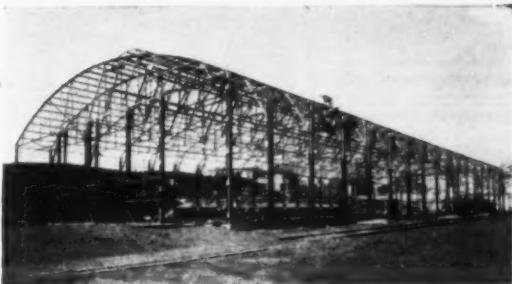
Verona Rail Joint Springs

Maintain better rail joint conditions as they have far greater reactive travel in that important 20,000 to 10,000 pound pressure range than helical spring washers.

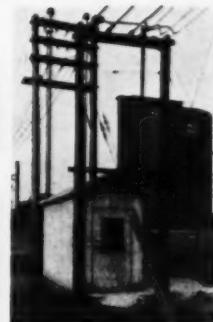
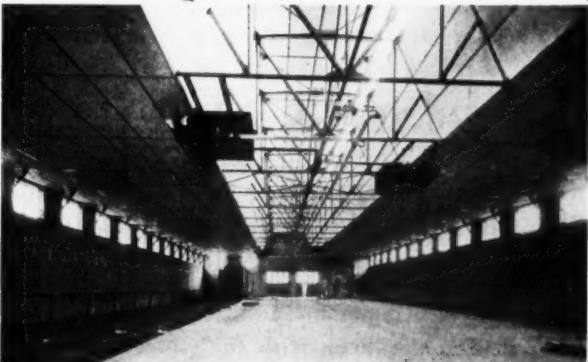


WOODINGS-VERONA TOOL WORKS
VERONA,
“Since 1873”
PENNA.

MADE ENTIRELY OF STEEL
BUTLER



READY-MADE
STEEL
BUILDINGS



Fruit Houses . . . Car Repair Shops . . . Truck and Bus Garages . . . Material Depots and Treating Plants . . . Scale Houses . . . Track Car Houses . . . Machine Shops . . . Signal Towers and Transformer Houses . . .

These . . . and many other railway structures . . . are now ready-made of steel . . . fit into railway economy programs better than any other fire-safe type of construction.

Standardized unit design facilitates quick assembly on location, enlarging, taking down and re-erection . . . complete, ready-made materials in orderly arrangement promotes quick installation without interruption . . . permanence is inwrought in both materials and structural design.

The standardized unit design of Butler Ready-made Steel Buildings is flexible. Butler engineers gladly collaborate to incorporate the ideas of railway engineers to fulfill particular requirements.



BUTLER MANUFACTURING COMPANY
1247 Eastern Ave.
KANSAS CITY, MO.

Send complete information on Butler Ready-made Steel Buildings, particularly a building approximately _____ ft. by _____ ft., to be used for _____

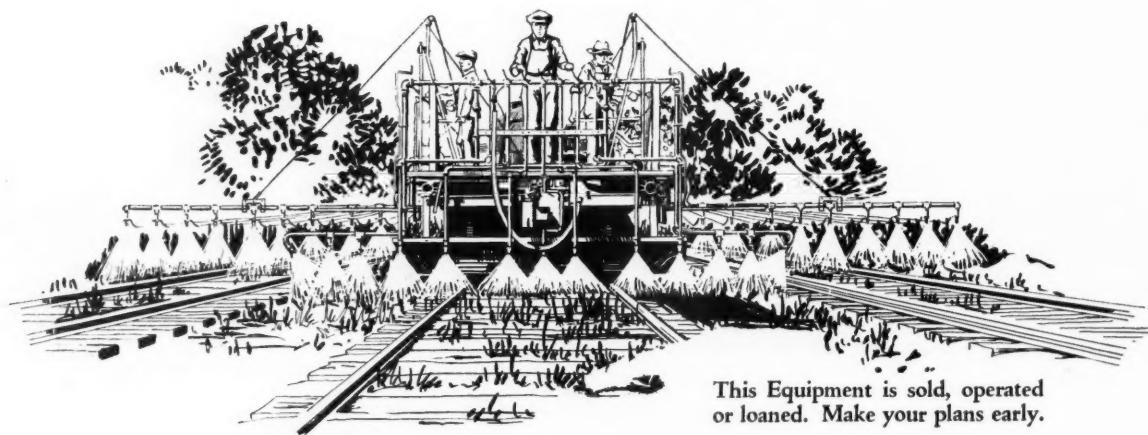
Firm Name. _____

Address. _____

At the top right is a photograph of the structural steel frame which carries the C. B. & Q. Fruit House. Its members are designed to give the greatest strength per pound of steel and fabricated in units such as to facilitate quick assembly. The large photograph shows the finished building with the panel corrugated wall and roof sections bolted into a finished exterior. The special Butler panel corrugation multiplies sheet steel strength fourfold over ordinary corrugating. The interior view above the inside insulation is accomplished with Nu-wood, a commercial wall board. Insulation and heating facilities are such as to maintain a 50 degree temperature in coldest weather.



MAKE SHORT WORK of WEED KILLING *fast—convenient—dependable*



This Equipment is sold, operated or loaned. Make your plans early.

WITH THIS SELF REGULATING FLAT CAR SUPER SPRAYER

THE weeding of track has long been one of the principal tasks of track men. It's a necessity and should not be neglected even for one year for it is uneconomical to let clean track get back into weedy condition.

Make short work of your 1932 weed killing problem by using the Chipman Flat Car Sprayer. This method is fast, convenient, dependable, effective and above all economical. The results are permanent and cumulative.

CHIPMAN GEARED-TO-THE-AXLE EQUIPMENT has averaged 108.1 miles of treatment per day with very splendid results.

How rapidly Chipman Chemical Weed Killing is replacing the "man with the scuffle hoe" is shown by the fact that 10 railroads used Atlas Calcium Chlorate in 1925 and increased to 129 railroads in 1930. Its effectiveness has been proven on more than 50,000 miles of track in the United States and Canada.

Chipman Chemical Engineering Co. Inc.
BOUND BROOK, N. J.

Chicago, Ill. Palo Alto, Cal. Houston, Tex. Atlanta, Ga. Kansas City, Mo. Winnipeg, Man.



Can You Afford to Let \$2.00 Keep \$43.00 Idle?

THE base price of rails today is \$43.00 per ton. If you have any rails in storage, you can't afford to let that \$43.00 a ton material rust and depreciate, when less than \$2.00 a ton will put it in service.

Rail laying now costs less than half what it did ten years ago—largely due to Nordberg Track Maintenance Machinery. In addition, you can get a better job of rail laying done than ever before. Better track means less future maintenance expense.

A few of the various types of Nordberg Track Machinery now in general use are shown here. Data on any or all of the Nordberg line will be furnished on request.

Railway Equipment Department

NORDBERG
MANUFACTURING CO.

Milwaukee

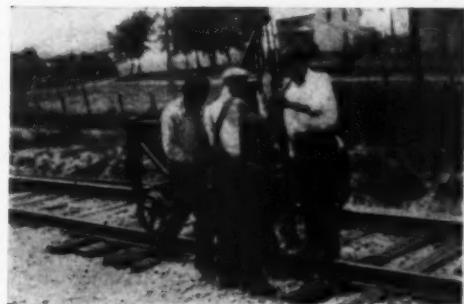
Wisconsin



Nordberg Power Jack

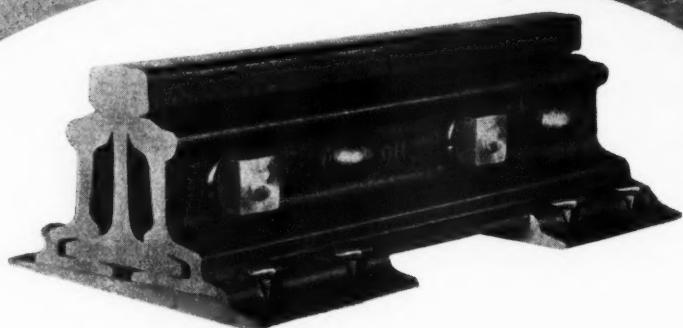


Nordberg Tie Adzer



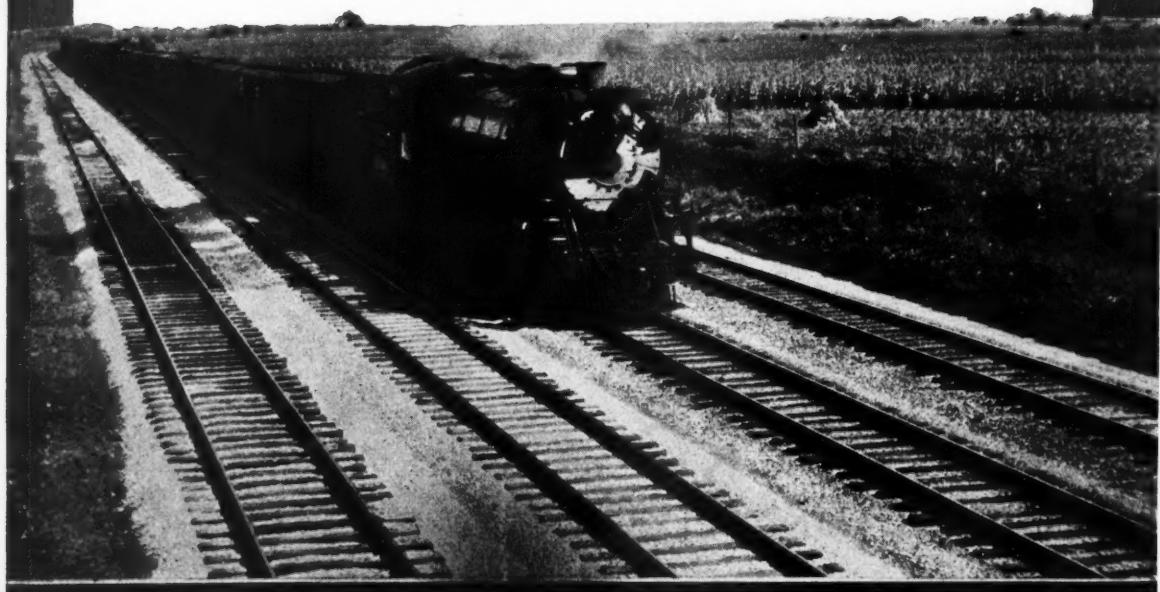
Nordberg Spike Puller

HEADFREE RAIL JOINTS

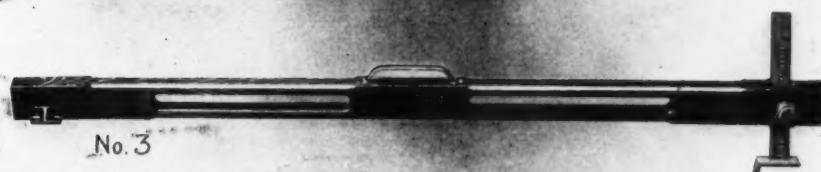


Make
Good Track
Better

The Rail Joint Company
165 Broadway, New York, N. Y.



Woodings Verona Track Levels



Winter's Approach Necessitates Track Surfacing

To assure satisfactory conditions use

WOODINGS VERONA LEVELS

Which are produced from best grade timber properly seasoned
and level assembly of accuracy.

Descriptive Circular upon request.

WOODINGS-VERONA TOOL WORKS

VERONA, PA.

"Since 1873"



The HIGH COST of manganese

Lowered commodity prices have left few items that railroads can reclaim profitably. But manganese crossing and frog reconditioning is still more profitable to every road than replacement.

No longer is manganese reconditioning an experiment. Three years of actual work for more than 20 of America's Class I railroads have proved Morrison's Metal-weld Process completely efficient and satisfactory.

Specializing in manganese welding, Morrison has the knowledge, ability, experience, technique and facilities for

emphasizes
the

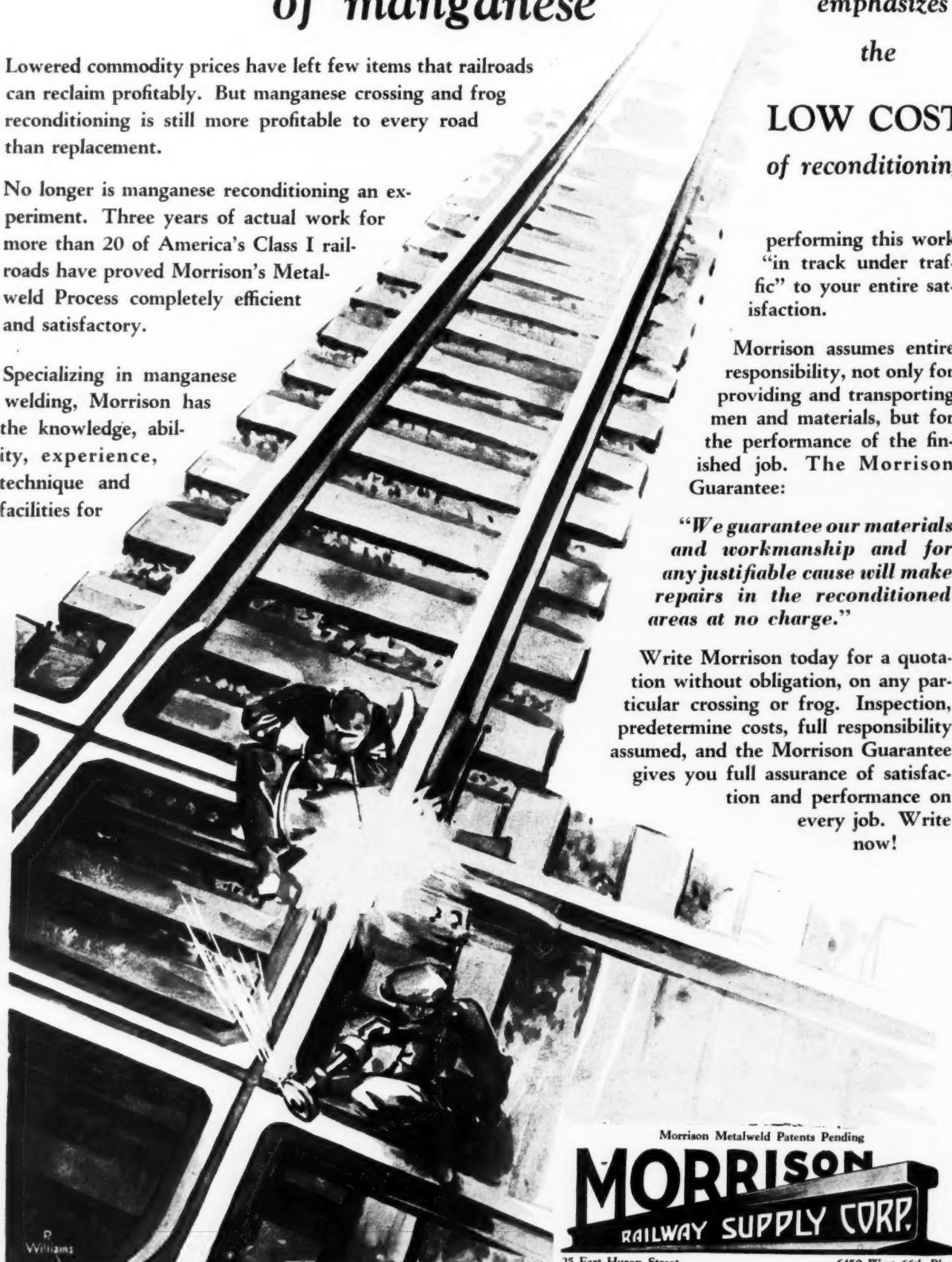
LOW COST of reconditioning

performing this work "in track under traffic" to your entire satisfaction.

Morrison assumes entire responsibility, not only for providing and transporting men and materials, but for the performance of the finished job. The Morrison Guarantee:

"We guarantee our materials and workmanship and for any justifiable cause will make repairs in the reconditioned areas at no charge."

Write Morrison today for a quotation without obligation, on any particular crossing or frog. Inspection, predetermine costs, full responsibility assumed, and the Morrison Guarantee gives you full assurance of satisfaction and performance on every job. Write now!

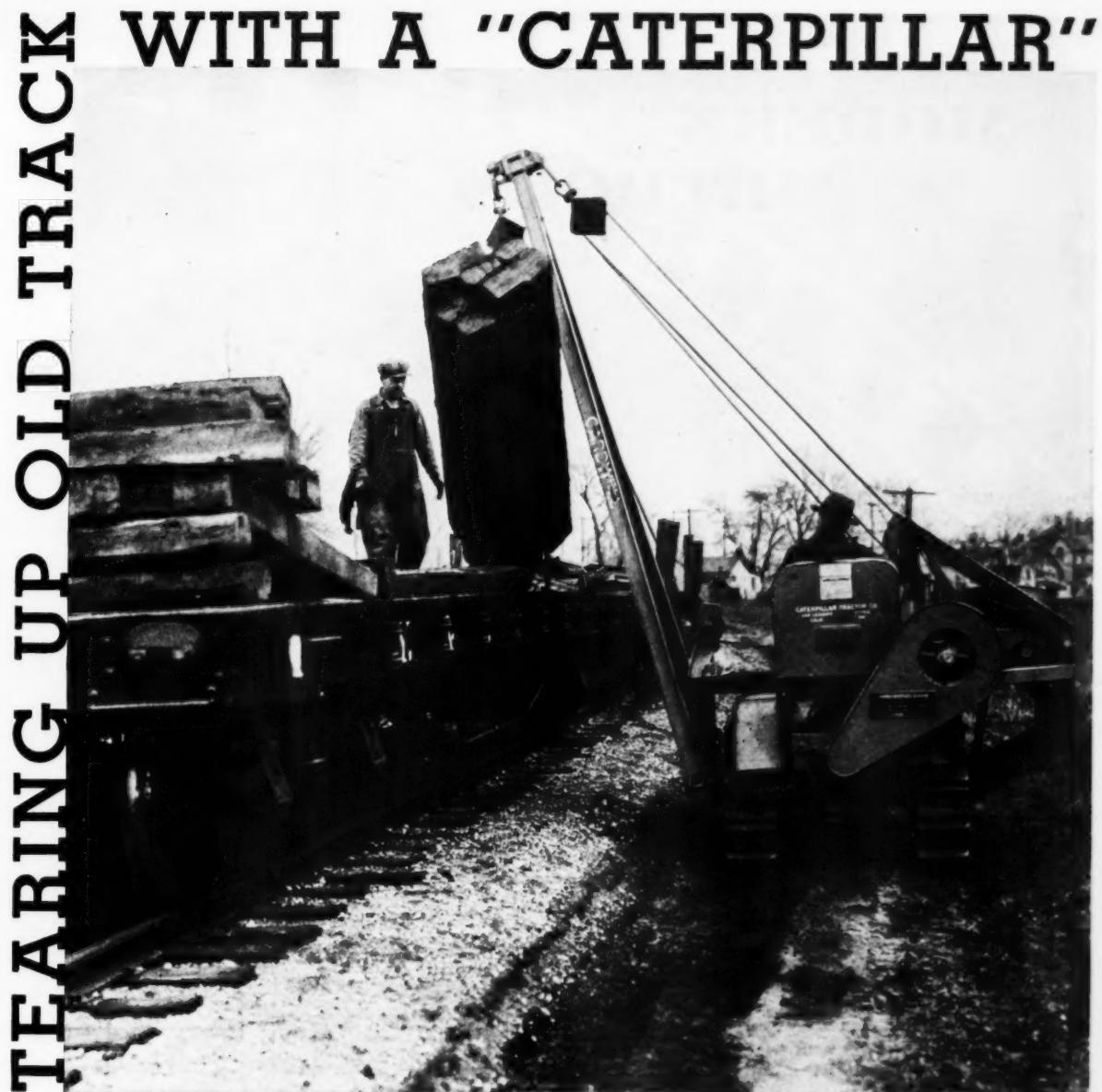


Morrison Metalweld Patents Pending

MORRISON
RAILWAY SUPPLY CORP.

25 East Huron Street
BUFFALO, NEW YORK

6450 West 66th Place
CHICAGO, ILLINOIS



THE pictures tell the story—the "Caterpillar" track-type Tractor is a Twenty fitted with an All-Steel side boom—the scene is on the right-of-way of the Nickel Plate Railroad. The "Caterpillar" needs no rails—it lays its own tracks—it goes anywhere where nimble power is needed!

Prices—f.o.b. Peoria, Illinois

TEN	\$1100	THIRTY	\$2375
FIFTEEN	\$1450	FIFTY	\$3675
TWENTY	\$1900	SIXTY	\$4175

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.
Track-type Tractors Combines Road Machinery

(There's a "Caterpillar" Dealer Near You)



CATERPILLAR
TRACTOR

REG. U. S. PAT. OFF.

MODERN METHODS

Southwark Railroad Shop Equipment

*Hydraulic Presses for Flanging,
Forging, etc.*

Bushing Presses

Wheel Presses

Power Punches and Shears

Plate Bending Rolls

Plate Planers

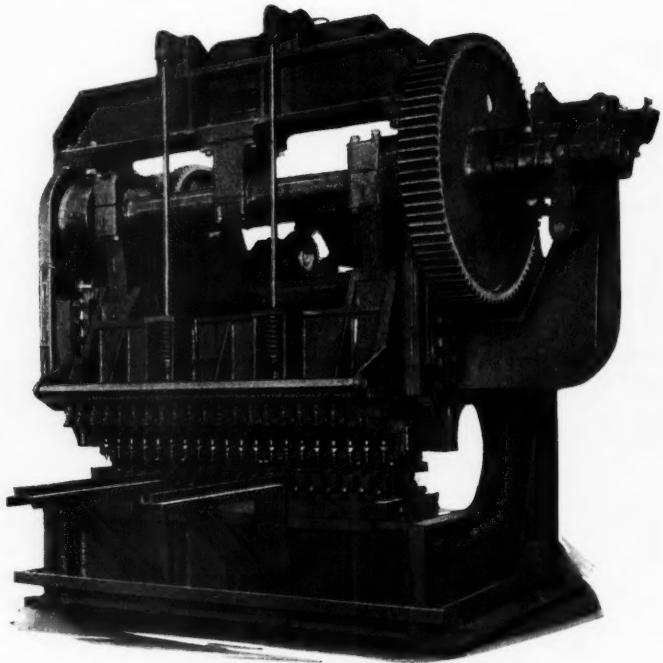
Hydraulic Riveters

General Boiler Shop Equipment

Special Machinery

Standard Track Scale Weight Test Cars

Southwark-Emery Universal Testing Machines



Multiple Punch Welded Steel Construction

THIS is one of many designs in Multiple Punches, made by Southwark.

The frame of this machine is fabricated from WELDED STEEL PLATE. Greater strength with lighter weight. Practically unbreakable.

Southwark Engineers will be glad to give you the benefit of their Ninety-Five Years of experience in the design of machinery for individual operations. They are specialists in the design of Hydraulic, Power and combination machinery.

Established 1836

**BALDWIN-SOUTHWARK CORPORATION
SOUTHWARK FOUNDRY AND MACHINE CO. DIVISION**

SOUTHWARK

AKRON

PHILADELPHIA

CHICAGO



GOHI FABRICATORS

THE PENNSYLVANIA CULVERT CO., Philadelphia
 DENVER STEEL & IRON WORKS CO., Denver, Colo.
 A. N. EATON, METAL PRODUCTS, Omaha, Nebr.
 FEENAUGHTY MACHINERY CO., Portland, Oregon
 TENNISON BROTHERS, Texarkana, Ark.
 CAPITAL CITY CULVERT CO., Madison, Wis.
 CENTRAL CULVERT CO., Ottumwa, Iowa
 ROANOKE SALES CORP., Roanoke, Va.
 ST. PAUL CORRUGATING CO., St. Paul, Minn.
 TENNISON BROTHERS, Oklahoma City, Okla.
 A. N. EATON, METAL PRODUCTS, Billings, Mont.
 THE NEWPORT CULVERT CO., Newport, Ky.

GREAT FLEXIBLE STRENGTH — Due to corrugations and the inherent nature of the metal — is a valuable quality of GOHI Culverts not found in other types. It is this quality that prevents breakage from the terrific pressures exerted by freezing earth and water, settling fills, and vibration from heavy trains. This flexible quality practically eliminates after-installation difficulties. Made of 99.90% Pure Iron-Copper Alloy, GOHI Culverts resist corrosion, last years longer, give lowest-cost-per-year drainage. Write to nearest GOHI Fabricator for full details. Photo shows GOHI Culvert, 36" in diameter and 246' in length, standing up to its job under fifty-foot fill.

GOHI CULVERT MANUFACTURERS, Inc.
 Newport, Kentucky



(Meet copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.)

GOHI
PRONOUNCED "GO-HIGH"
Corrugated
CULVERTS



Bolting-up rail joints with No. 99C Wrench in one-fourth the time of hand methods.



Driving cut spikes in $3\frac{1}{2}$ seconds with CC-250 Spike Driver.



Boring a screw spike hole in $5\frac{1}{2}$ seconds with CCW Woodborer.



Pulling 10 spikes per minute with No. SP9 Spike Puller.

For Rail-Laying Work

A complete line of air tools
and air compressors

There are Ingersoll-Rand spike drivers, spike pullers, wrenches for bolting and unbolting rail joints, rail drills, bonding drills, woodborers, etc.

Used with I-R Compressors they are an effective means of obtaining lower costs.

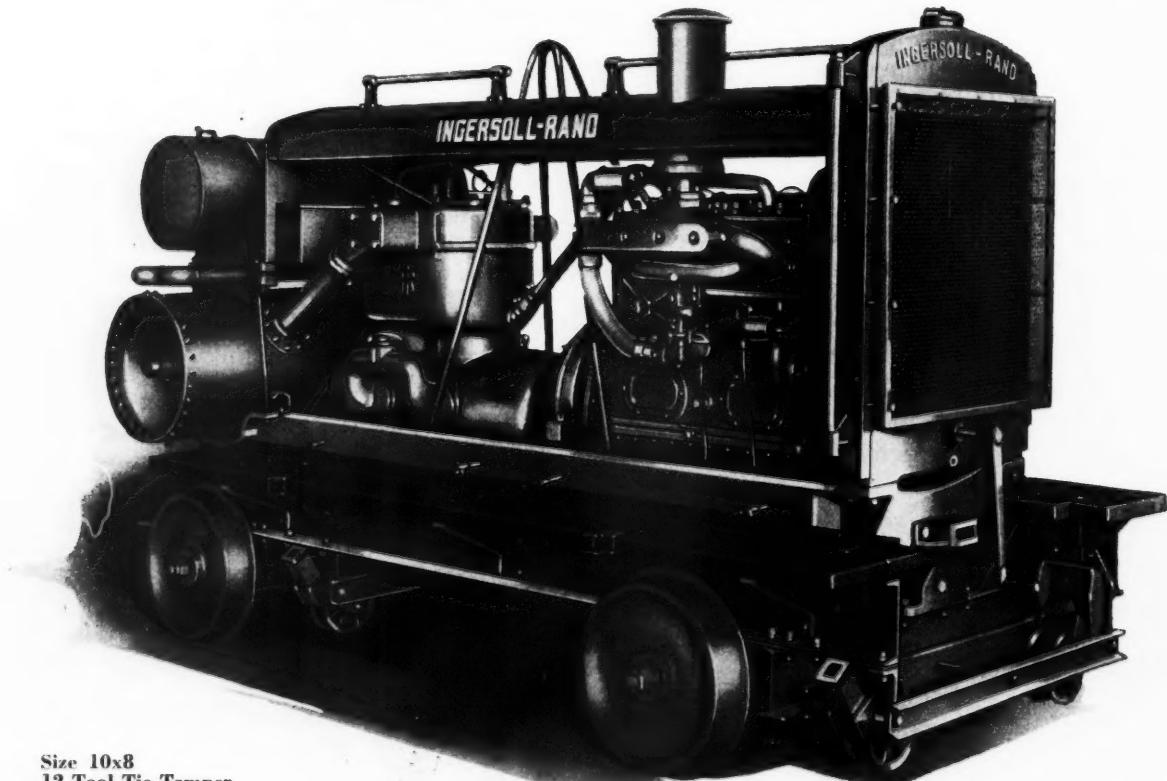
INGERSOLL-RAND COMPANY
11 Broadway, New York City

Branches or distributors in principal cities the world over



Drilling a rail in 25 to 30 seconds with No. 99 Rail Drill.

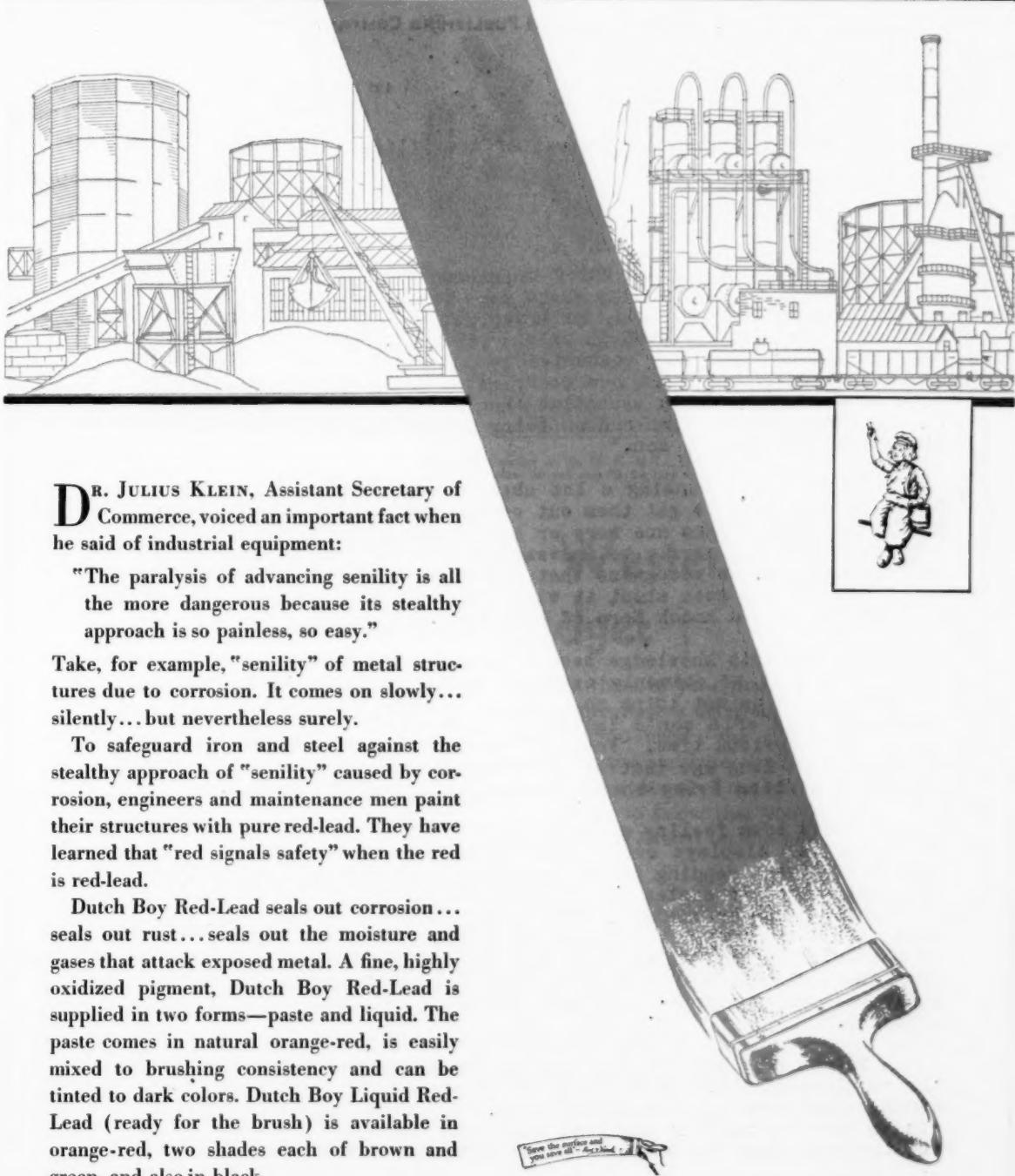
Ingersoll-Rand



Size 10x8
12 Tool Tie Tamper
Air Compressor

292-TT

WHERE RED SIGNALS SAFETY



DR. JULIUS KLEIN, Assistant Secretary of Commerce, voiced an important fact when he said of industrial equipment:

"The paralysis of advancing senility is all the more dangerous because its stealthy approach is so painless, so easy."

Take, for example, "senility" of metal structures due to corrosion. It comes on slowly... silently... but nevertheless surely.

To safeguard iron and steel against the stealthy approach of "senility" caused by corrosion, engineers and maintenance men paint their structures with pure red-lead. They have learned that "red signals safety" when the red is red-lead.

Dutch Boy Red-Lead seals out corrosion... seals out rust... seals out the moisture and gases that attack exposed metal. A fine, highly oxidized pigment, Dutch Boy Red-Lead is supplied in two forms—paste and liquid. The paste comes in natural orange-red, is easily mixed to brushing consistency and can be tinted to dark colors. Dutch Boy Liquid Red-Lead (ready for the brush) is available in orange-red, two shades each of brown and green, and also in black.

For full information about protecting metal surfaces with red-lead, write for our booklet—"Structural Metal Painting." Our nearest branch will gladly forward a copy upon request.

NATIONAL LEAD COMPANY

New York, 111 Broadway—Buffalo, 116 Oak Street—Chicago, 900 W. 18th Street
—Cincinnati, 659 Freeman Avenue—Cleveland, 820 West Superior Avenue—St.
Louis, 722 Chestnut Street—San Francisco, 2240 24th Street—Boston, National-
Boston Lead Co., 800 Albany Street—Pittsburgh, National Lead & Oil Co. of
Pa., 316 Fourth Ave.—Philadelphia, John T. Lewis & Bros. Co., Widener Bldg.

D U T C H B O Y R E D - L E A D

No. 36 of a series

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: The Survival of the Fittest

November 25, 1931

Dear Reader:

While talking to the chief maintenance officer of one of our large railways a few days ago about some further reductions in staff that he was being forced to make, he broke out with the statement; "Howson, this is a day of the 'survival of the fittest'. The time is past when one can effect necessary economies by eliminating needless work or individuals. The problem now confronting me is that of determining what task or what man is less essential than another. I am looking more and more for the best man and am being forced to give less and less thought to the average man."

I have been thinking a lot about these comments. In fact, I have not been able to get them out of my mind. Who is the best man? How is he selected? These are more or less indefinite questions which I realize cannot ordinarily be answered off hand. Yet, as you and I compare two men, we recognize that one seems to have a better way to tackle a task and goes about it with less lost motion. In other words, he seems to have a knack born of knowledge.

How has this knowledge been acquired? Has it come from that intuition that is so commonly credited to the opposite sex as a substitute for reason? I do not think so. Rather, I have a conviction that somewhere back of a man's initiative is a latent idea that he has stored up at some previous time. Possibly the idea came from the reading of an article so long ago that he has forgotten its source, but the idea has nevertheless been lying there awaiting opportunity for use.

I have been feeling more and more of late that the superiority which one man displays over a fellow employee is in reality a reflection of diligent reading of the practical experience of others, and that this tips the scales in favor of one man rather than another more frequently than we realize, not only in times like these but also in more normal days when vacancies are being filled and promotions made. If the days that are ahead of us are to demand still greater efficiency than those through which we have passed, the struggle will be increasingly keen and reward will go more and more to those who are best prepared.

We who edit Railway Engineering and Maintenance take very seriously the requirement that the material which we present to you from month to month be gathered on the firing line, in the belief that it will aid you in meeting similar problems when they arise and will thus give you the edge over the man who is not similarly prepared.

Yours truly,

Elmer T. Howson

Editor.

ETH*JC



Sturdy Western 20-yard drop door cars in ditching service on the M. K. & T. The low height of these cars permits the ditcher to dig farther below the rail and fill the cars to capacity.

Put Drop Door Westerns In Your Budget

Put them in, anyhow. You know without telling that there never were better cars made than Western Drop Door Air Dump Cars. You need them to cut the cost of ditching. You need them in all your betterment work.

So put them in your Budget, anyhow. If purchase is deferred, rent as many as you need—the rental to apply on future purchase—and watch your costs go down. You will sleep better nights to know that you have Drop Door Westerns on the job.

All practical sizes for construction work—20 yard for ditching; 30 yard for construction work. The 7-foot reach of the drop door cuts spreading costs. Great strength and use of standard shapes cut repair costs. Single stroke, simple acting air cylinders cut dumping costs. Low loading height permits your ditcher to dig deeper.

Write for Catalog 81 for full information.

Western Wheeled Scraper Company

Dump Cars and Grading Equipment

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Railway Engineering and Maintenance

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DECEMBER, 1931

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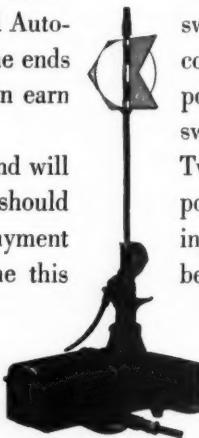


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SPECIALISTS IN TRACK-WORK MATERIALS

Railway Engineering and Maintenance



TAXES

A Burden of Triple Import to Railway Employees

AT the present time when so many men are unable to secure employment, there is one person who is working more industriously than ever before. He is the tax gatherer. His activities are of very direct concern to every railway employee and of scarcely less concern to every other person, for he is exacting an increasingly heavy toll directly and indirectly from every individual. Furthermore, by his very activity he is making it more difficult for the railways and other employers of labor to provide work for those who normally look to them for a livelihood by reason of the increasingly large sums that are being extracted from the earnings of industry to finance governmental expenditures. To make matters still worse, numerous propagandists are taking advantage of the present conditions to promote pet projects of their own under the guise of providing employment, which will add still more to the already excessive tax burdens, not only for the next few months but for years to come. It is especially important, therefore, that every railway employee understand the full effect of these suggestions on his own welfare in order that he may be guided accordingly in the use of those franchise privileges and other prerogatives that are his.

The Total Tax Bill

Let us look at the trend of the aggregate tax bill in recent years. In 1913, the year before the outbreak of the war, the taxes paid by the American people totaled \$2,187,000,000. In 1923, five years after the war had ended, they had increased to \$7,234,000,000. Five years later, or ten years after the close of the war, they had grown to \$9,289,000,000, a further increase of more than \$2,000,000,000 or 28 per cent. Measured in another way, taxes consumed 6.4 per cent of the entire national income in 1913, whereas in 1923 this proportion had risen to 10 per cent and in 1928 to 12 per cent.

While the increase between 1913 and 1923 can be attributed primarily to the war, the same cannot be said of later years. Rather, these more recent increases have been due in large measure to extravagances in our local, state and national governments, involving large expenditures for highways, waterways, etc. In view of the recent agitation from certain quarters against the petition of the railways for a 15 per cent increase in freight rates, wherein much was made of the contention that the nation

could not stand this increase, it may be pointed out that the total tax bill of the nation is now *three* times the total railway freight bill and that this ratio is increasing steadily; yet there is no concerted outcry against taxes, even though every consumer contributes to it just as directly as to the railway freight bill.

Railway Taxes

So much for the tax bill as a whole. Let us now turn to that portion paid by the railways. In 1902, the taxes paid by the railways passed \$50,000,000 for the first time. Nine years later they crossed the \$100,000,000 mark. In 1917 they exceeded \$200,000,000, in 1922 they crossed the \$300,000,000 mark, and in 1929 they totaled \$402,000,000.

Measured in another way, taxes took 2.8 cents of every dollar of revenue received by the railways in 1890, 3 cents in 1900, 3.5 cents in 1910 and 4.4 cents in 1920. By 1930 this toll had risen to 6.6 cents, while in the first nine months of 1931 it was 7.52 cents, an all-time high record. That this increase constitutes a most serious drain on the railways is shown by the fact that if the ratio during the current year had been only that of 1920, the railways would have had \$150,000,000 more to spend for wages and materials than they now have, or nearly one-third of the amount which they had hoped to receive from the increase in freight rates.

That the railway tax payment frequently constitutes one of the largest, if not the largest single contribution to public support in many localities is shown by a study just made of the taxes paid by the Norfolk & Western in each of the counties traversed by its lines, wherein it was found that the railroad taxes paid in all of these counties averaged 18.36 per cent of the total taxes collected and in some counties ran as high as 37.86 per cent.

Taxes and Pay Rolls

Still another comparison will drive home to railway employees the inroads which the tax gatherer is making on the funds which would otherwise go largely for labor. In 1903, the railways paid \$1 in taxes for every \$14 in wages. In 1913, the ratio was \$1 in taxes to \$11 in wages. In 1923, the proportion had risen to \$1 in taxes to \$9 in wages, while in the first eight months of 1931 the tax gatherer took \$1 for every \$6.68 paid employees. The effect of such drains on the ability of the roads to maintain their pay rolls is evident—especially when it is recognized that the tax collector must be satisfied first.

Still another comparison is afforded by a study of the railway fuel bill. The purchase and use of railway fuel are, of course, under the control of the railways. The taxes which the railways must pay are determined by governmental authorities. It is of interest to note, therefore, that whereas in 1920 the railways' tax bill was \$400,000,000 less than their fuel bill, in the first eight months of 1931 it was nearly \$73,000,000 larger. Again, the railways' fuel bill was only 5.1 per cent of their total earnings in the latter period as compared with 10.9 per cent in 1920, while the railway tax bill, on the other hand, was 7.5 per cent of total operating revenues as compared with 4.4 per cent in 1920.

Working for the Tax Collector

What does all this mean? In the first nine months of 1931, net revenues from railway operations totaled \$754,763,396 and taxes aggregated \$246,523,010, or 32.6 per cent of the net revenues. At this rate, the railways will be working for the tax collector rather than for their owners for 119 days this year or approximately 4 months. Expressed in another way, the tax collector is now taking the entire net revenues from more than 80,000 miles of lines, 18,000 locomotives, 17,000 passenger cars and 750,000 freight cars and other property in proportion, a property greater than that of the railways in all of the states west of the Missouri river, excluding Texas. Expressed in still another way, taxes consumed the net earnings produced by the labor of more than 400,000 men, a number 25 per cent greater than the total now employed in the maintenance of way department.

Nor are these present payments, large as they are, the entire story, for under the guise of promoting employment in the present crisis, advocates of numerous projects are now clamoring for further public support for their projects. As an illustration, the Mississippi Valley Association, an organization of waterway advocates of the Middle West with much political backing, voted on November 23 to urge Congress to authorize a federal bond issue variously placed at \$400,000,000 to \$500,000,000 for the prosecution of work on the inland waterway system. Within the same week, a large motorists organization proposed a similar bond issue, again of federal funds, for the construction of more highways. And so it goes.

The Railway Employee Must Awaken

The one hope in the situation is the fact that the people at large are becoming aroused to the necessity for curbing this drain on our business and civic life and are demanding that public expenditures be made with at least the same care that private expenditures are. As an indication of the growing appreciation of this attitude, a speaker from Detroit, Mich., in an address before the Chamber of Commerce of the United States last April stated that "No increase in taxes can be justified by any state that continues to indulge, as does Michigan, in the unpardonable luxury of spending \$50,000,000 a year on a state highway program at a time when over 450,000 parcels of property (in that state) are in a single year being sold and confiscated from private owners for unpaid taxes." And this is a typical condition.

Railway employees are suffering from this tax-spending orgy in at least three ways. In the first place, as individual citizens they are required to bear their share of the tax burden directly and from consumer taxation. Then as railway employees they suffer to the extent that the money which the railways would otherwise spend for needed improvement and upkeep of their properties is being seriously depleted by the excessive drains for taxation, necessitating reductions in forces, shorter hours, etc. A third consideration is the fact that large sums raised by taxation are being employed to build highways, waterways, airports, etc., to attract traffic from the railways and reduce their earnings, again curtailing the opportunity for employment.

The tax problem, therefore, constitutes a triple threat to the railway employee. To the extent that individual employees recognize this situation and to the extent that they then take those measures which are within their power to inform their neighbors and to build up a public sentiment that will correct this situation, they are promoting their own interest and, at the same time, making a definite contribution to that sane thinking which is so necessary to a return of prosperity in this country.

WINTER WORK

Plan Carefully for Productive Results

ONE of the troublesome problems that always confront maintenance officers at this time of year, and one which cannot be solved in general terms, is that of determining how to employ the reduced maintenance forces to get the greatest productive results from their labor. Where a section gang is reduced to the foreman and one man, little work of major importance can be done even in favorable weather. As a result, the section forces are prone to confine their attention to the lighter kinds of work that can be interrupted without detriment, such as policing, gaging, respiking, minor repairs to switches, etc.

A definite suggestion with respect to winter work is contained in the answers to the question about repairs to fences, which appear in the What's the Answer department of this issue. All of those who answered this question said unhesitatingly that winter is the proper time for making repairs to fences. They stress the importance, however, of careful planning and the necessity for having the fence material, particularly the posts, on hand at the proper time.

In discussing this subject, the engineer maintenance of way on the Burlington cites as an example a district of 110 miles in the West, which passes through a section where stock raising is the principal industry. Those who are familiar with similar conditions know that the importance of keeping the fences in good order is almost on a par with that of maintaining good track. On this district, through a program of winter repairs carried out consistently over a period of years, the fences have been maintained in excellent condition at minimum expense, although at no time during this period has the force on any of the sections exceeded a foreman and one man during the winter months.

On many sections the fence repairs consume little time. If the supervisory officer is alert, however, and has started his planning months ahead, he will find numerous other constructive jobs which can be completed by his winter forces, and which if completed at this time, will not arise later to interrupt his summer program when attention should be concentrated on track maintenance.

PROMPT ACTION

Greater Authority for the Foreman will Help

THREE are many miles of railways in this country on which the winter track force consists of the foreman and one man or the foreman alone. Larger section forces frequently cannot be justified on light traffic branch lines with no interlocking plants or important stations and only a minimum of turnouts and sidings, in territories where the roadbed is frozen solid for several months and the conditions are such that heaving does not impose any serious difficulties.

But no matter how small the force, it must be able to function as the nucleus of the enlarged organization that may be required at any time to meet such emergencies as storms, train accidents and broken rails. As a rule, authority to increase the force on such occasions rests with the supervisory officer, but because he cannot always be within reach of the section foreman who needs help, the roadmaster cannot exercise his authority in all cases with the desired expedition. Realizing the shortcomings of this arrangement, some railways have given their foremen the authority to hire extra men in whatever numbers are needed when and for the time required to meet extraordinary needs, with the proviso that they must notify the supervisor promptly of such action and explain the necessity for it. This plan has worked well. It has made for prompt action and, what is significant, it has resulted in no abuse of the authority by the foremen. This arrangement merits investigation.

WINTER CONCRETE

It Is Essentially a Problem in Economics

WHOMO has not seen concrete placed in winter with no other protection from the cold than a covering of straw or manure so thin and indifferently placed as to convey the impression that these materials must be possessed of some extraordinary protective qualities that will compensate for the carelessness or indifference of those responsible for the job? In contrast with such disregard for ordinary rules of common sense in winter concreting is the attitude of those who oppose the placing of concrete in winter under any circumstances. Such ultraconservatism is just as unwarranted as the evidence of carelessness cited above.

Concrete has been and is being placed during the winter with full assurance that the quality will be just as good as that placed during the summer. There is nothing mysterious about the measures that are necessary

to obtain such results. Methods of heating the aggregates and mixing water and of protecting the concrete in the forms have passed the experimental stage. They have been employed often enough to provide accurate information as to the cost of insuring that concrete structures of various types and designs may be built safely under different conditions of weather and temperature.

This does not mean that it is possible to justify winter concrete work under all circumstances, but rather that it is possible to weigh the extra cost of winter work against the advantages to be gained. Why not approach the problem from the standpoint of real economics rather than on the basis of any preconceived prejudices in favor of or opposed to the practice?

HEAT TREATMENT

A Remarkable Development in Rail Conservation

AMONG the outstanding developments of the last four years in measures to increase the life of rail is the heat treatment of the running surface of the ends as a means of providing increased resistance to end flow and batter. This advance is the work of certain officers of the Chicago, Milwaukee, St. Paul & Pacific.

This process of heat treatment, which is being presented to railway men as a whole for the first time in the article on page 1040 of this issue, had its beginning in the observation of the behavior of open hearth frogs and crossings that had been built up by the oxy-acetylene process as influenced by variations in certain details of workmanship. This, together with the well known fact that built up rail ends are more resistant to flow than the ends of new rails, led to the suggestion that the oxy-acetylene torch might be used as the means of applying a heat treatment. The way in which this idea was developed, the extent to which it has been applied and the results obtained are clearly set forth in the article.

That the Milwaukee's heat treatment process is being watched with interest is evident from the number of railway officers who have taken the trouble to observe its application and inspect track to which it has been applied, and from the fact that at least one other railway, the Pennsylvania, is doing experimental work along the same line, although differing in some details.

In its present state, it would appear that the process is one which introduces no added hazard in the form of an increase in rail breakage and that the cost of this treatment is justified by the added life given to the rail by reason of a marked reduction in flow of metal in the running surface at the joints. The number of joints which the Milwaukee has already subjected to this treatment is now large enough to warrant the hope that within a year or two conclusive evidence will be available of the exact merits of process. If the results then to be forthcoming measure up fully with those now available, we may expect to see the widespread adoption of this practice, with the result that the oxy-acetylene torch may find its primary use in track work as a measure for preventing batter rather than as a means of repairing damage already done.

Heat Treating of Rail

New process developed
applied to 275,000
to increase

AN INTERESTING innovation in rail maintenance, designed to extend the life of the rail by reducing the rate of joint batter, has been in progress on the Chicago, Milwaukee, St. Paul & Pacific since 1927. During the five years in which this process has been developed and applied, more than 275,000 joints, or in excess of 1,000 miles of track, have been treated, with the result that the service life of the rail has been definitely increased.

Simplicity and low cost characterize the process, while the results that have already been attained, as well as the prospective benefits, far overshadow the relatively small expense involved. The process consists of heat treating within closely controlled limits the running surface at the ends of the rails to increase its resistance to the severe stresses which are set up by the moving wheel loads. It is of interest that the idea of doing this originated in the maintenance-of-way organization of the road, while the method has been developed and the technic of the process perfected by the staff of that department.

In 1926, the Milwaukee began to recondition its battered rail joints by welding and has followed the practice consistently since. It was soon observed, as it has been elsewhere, that the welded joints were more highly resistant to batter than those that had not been built up, while the same effect was also noticed with respect to frogs and crossings that had been similarly reconditioned. It was known that the welded metal was somewhat higher in carbon and, therefore, slightly harder than the normal rail steel. The point which attracted most attention, however, was that some of the welders working on open hearth frogs and crossings quenched the heated metal with water while others did not. It was then observed that no flow of metal could be detected in the quenched areas while perceptible flowing began after a time in the unquenched frogs and crossings.

Genesis of the Idea

Interest was aroused by these phenomena, which led to the thought that, since the quenching doubtless still further increased the hardness of the welded metal, perhaps the secret of the higher resistance to batter might be found in this simple quenching operation. Following this thought further, it occurred to certain members of the maintenance-of-way staff of the road that a higher resistance to batter at the joints might be obtained in new rails through some practicable method of treatment which would harden and toughen the metal at the ends.

Accordingly, experiments were undertaken with a view to finding some practicable method for accomplishing this purpose. Specimens of rail steel were heat treated in several ways and to various temperatures and tested for hardness, tensile strength and elongation. Finally the basic features of the present method were developed and 55 rails were treated at their ends in July, 1927, and placed in service. The treated area, which extended about 2 in. from the end, was heated to 1,450 deg. F. and quenched with water. Some chipping and shelling occurred within two or three months, but the joints that did not develop these defects retained an excellent running surface and all flow of the metal over the end of the rail apparently had ceased.

As a result of the satisfactory performance of these rails, a further test was made, in 1928, on five miles of

rail that was to be laid in the vicinity of Mt. Carroll, Ill. The method of heating and quenching the rails was fundamentally the same as with the first lot. In this case, however, it was decided to bevel the ends slightly, with the purpose of avoiding contact in the region of the running surface when the rails came together through expansion. To do this, a hot-cut chisel was forced into the expansion gap while the rail ends were red hot. This apparently reduced but did not eliminate the chipping



The first step (1) is to cross-grind a V-shaped slot at the rail ends, using a power grinder. Next (2), both rail ends are heated with an oxy-acetylene torch to a temperature of 1,500 deg. F. In this step the pyrometer (3) affords a definite check



Ends Prevents Batter

by Milwaukee has been
joints at low cost
service life

and shelling, as some of the rails developed these defects after a few months of service.

Taken as a whole, however, the performance of the rails treated in 1928 was better and indicated that the process as then developed had large potential possibilities. In the meantime, intensive study was being given to improve the methods of applying the treatment and perfecting the technic of the various operations. In 1929, treatment was applied to 6.4 miles of rail between

Powersville, Mo., and Lucerne, and to 10 miles between Cedar Falls, Wash., and Garcia. This was all new rail and a coarse file was used to give a $\frac{1}{16}$ -in. chamfer to the rail ends before they were laid in the track. At the same time the process was extended to include reheating after quenching, in the expectation that it would eliminate the chipping and shelling. The treating heat was retained at 1,450 deg., but immediately after quenching the treated area was reheated to 500 deg. and allowed to cool naturally.

A definite improvement with respect to shelling and chipping was now observed, but another factor, considerable variation in the hardness of the metal, had been introduced. Further studies in the light of the experience thus far obtained led to the decision to raise the treating temperature to 1,500 deg. and the reheating temperature to 650 deg. Within practicable limits these are the temperatures that are now being applied on all work of this character.

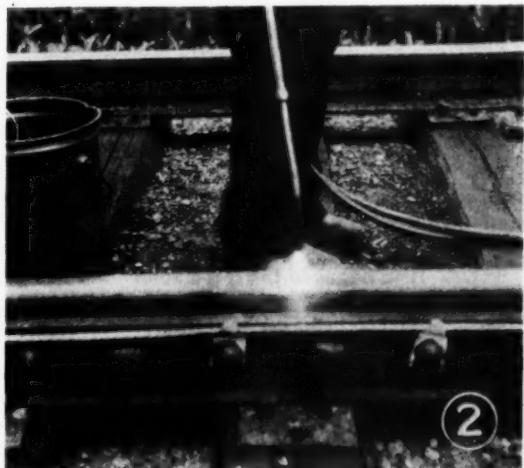
During the period of the development up to this time some mistakes were made and some of the results were disappointing. The general performance of the treated rails indicated clearly, however, that only minor adjustments were necessary in the process and the technic of applying it, to make it both economically and physically successful.

Heat-Treating the Rail as It Is Laid

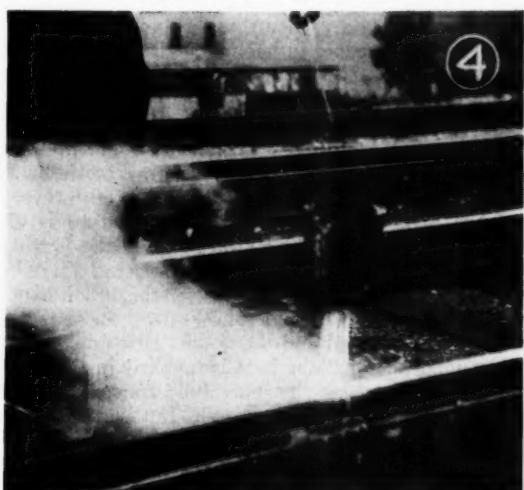
Being assured that the heat treating of the rail ends in this manner could be justified economically and that the process had been developed to the point where it was dependable and could be applied to give uniform results, 116 miles of new rail were treated in 1930. Hand methods having been found to be too slow and too costly, a power grinder was used this year to chamfer the rail ends and provide a V-shaped notch between abutting rails. This is the present stage of the development of the process, which, so far as can be observed, is giving the desired results and is being applied as a regular maintenance practice to all new rail that is being laid and also to all rail already in service, which has been laid since 1927. Up to October 1, more than 1,000 track miles of rail had been treated, including that already mentioned, or a total of more than 275,000 joints.

Established principles of heat treating are followed closely. From a heat-treating standpoint the method of procedure is somewhat unique, however, but this is so only because the treatment is given after the rails are in the track. The actual operations are relatively simple, the sequence being the grinding of the V-shaped slot, the heat treatment, the quenching and the reheating.

It was discovered early in the period of development that if the full measure of advantage was to be realized from the treatment, it became of the utmost importance that every step of the process be under close control. Brittleness must be avoided, as well as decarburization and softening of the metal. The objective is the maximum hardness that is compatible with a toughness that will insure against chipping and shelling. To accomplish this, the variations in the temperature and the time of applying the heat must be kept to the lowest practicable limits, thus insuring that the treatment will be given uniformly to all rails, as well as over the area that is being treated.



on the operator's judgment of the temperature. Immediately after the proper temperature has been attained the rail ends are quenched (4) with water that is sprayed on the rail from a quart can that has a series of small holes punched in its bottom.



In the early period of heat treating the work was done by several independent gangs, but during 1931, these gangs were consolidated into a single organization. This gang now consists of 1 general foreman and 3 assistant foremen, each of the latter being in charge of a unit consisting of 11 men. Each unit is comprised of 2 men cross grinding, 3 men heating, 3 men quenching and 3 helpers. Of the latter, one helper reheats the treated rails, another operates the motor car that pulls the outfit and the third tends to the equipment on the cars. The equipment for one unit consists of 20 cylinders of oxygen, 20 cylinders of acetylene, together with the necessary hose, torches and pressure regulators, and several



Reheating Temperatures Are Checked With a Stick of Solder

barrels of water. The whole outfit is carried on several push cars which are pulled by a large motor car.

Oxy-acetylene torches of special design, which give an oversize flame and consume from two to three times the volume of gas that is required for the ordinary heavy-duty type of welding torches, are used for both the heating and the reheating operations. To conserve gas, each torch is fitted with a shut-off button and a pilot flame so that the full volume of gas is used only while the heating is actually under way. This feature of the design saves about one-third of the gas.

Sequence of the Operations

Preceding the heating force, the cross grinders, working alternately, cut a V-shaped notch $\frac{1}{8}$ in. deep and $\frac{1}{4}$ in. wide across the top between the abutting rails. In other words, each rail end is given a $\frac{1}{8}$ -in. chamfer. This is done with a grinder which is driven through a 10-ft. flexible shaft by a small gasoline engine.

Following the grinders, each of the three men with torches, heats in one operation the abutting rails across the full width of the head and for 2 in. back from the ends. After some experience an operator is able to determine by eye when the metal has been raised to the proper temperature. As a check on his judgment, and to insure that the heating will be to the required standard and uniform for all rails, the foreman makes frequent checks with a contact pyrometer just as the operator says that the proper temperature has been attained. Experience has shown that it is not necessary to check every joint after the operator's eye has been calibrated through close observation and training. Owing to the relative softness of the heated metal, the pointed rods of the pyrometer penetrate the surface slightly, so that the

thermocouple gives an almost instantaneous reading which is translated on the dial into degrees Fahrenheit.

Time is an important element in the heat-treating operation. For this reason, a helper stands by, prepared to start quenching the instant that the torch is removed. His equipment consists of a galvanized water pail and a quart can, in the bottom of which a row of $\frac{1}{8}$ -in. holes has been punched. When the quenching temperature is reached, the streams of water from the bottom of the can are moved back and forth over the heated area until steam bubbles are no longer formed. It has been found in practice that there is no advantage in cooling the metal below the boiling point of water, while the cessation of steam generation affords a convenient indication that there has been sufficient drop in the temperature.

No interval is allowed between quenching and reheating. In this operation a torch is used that is identical with those employed by the heaters, and the flame is played over the quenched area until the temperature rises to 650 deg. The visual indications of the lower temperature are not so clearly defined, so that another method of control is necessary. After many experiments, it was found that the use of half-and-half solder provided the closest control and practically eliminated the time element in making the determination. As the temperature approaches 650 deg., a stick of the solder is drawn across the heated metal, leaving a silvery trace. If the streak turns a golden brown within two or three seconds, the metal has been properly heated. If the change in color is delayed, further heating and another test are necessary. After reheating, the metal is allowed to cool naturally to atmospheric temperature.

Time Required to Treat a Joint

It requires about 60 sec. in the summer and 70 sec. in the winter to heat the rail ends to 1,500 deg., while the whole cycle of heating, quenching, and moving to the next joint takes about 2 min., or an output of 90 joints an hour for the three operators. Owing to the higher initial temperature and the lower final temperature, one man can reheat as many joints as three heaters are able to treat.

While the time of completing a cycle was given as 2 min., the interruptions and delays that are always incident to work of this character, the necessity for filling the water barrels and for unloading and replacing the empty gas tanks and for connecting the loaded tanks for service, reduce the average production per torch to about 135 joints in an 8-hr. day. The average progress for a unit is, therefore, about 400 joints a day, although a single unit has treated as many as 750 joints in 10 hr. The method of procedure in beginning the day's work is for the first unit to pass over 800 joints from the starting point, the second unit to pass over 400 joints and the third one to start where the work was left off.

It was learned early in the investigation, and this has been confirmed in practice, that close control of the temperatures and certain precautions were required in every step of the process. If the surface temperature is allowed to go much beyond 1,500 deg., or if the heating to or above this point is continued too long, there is danger of decarburizing the steel. On the other hand, if this temperature is well under 1,500 deg., the required hardness is not obtained and the results lack uniformity. It is also important that the heat be applied just beyond the cone of the flame, so that only fully consumed gases come into contact with the metal. Furthermore, the region immediately beyond the cone is the hottest part of the flame, so that greater economy of heating is obtained.

There are two other reasons for the particular time of

heating that has been adopted. If the surface is heated too rapidly, the temperature gradient becomes too sharp, with the result that the unequal expansion is quite likely to develop internal shear between the heated and unheated zones of sufficient magnitude to cause incipient cracks. On the other hand, the rise in temperature should be rapid enough to localize the heat and confine it to the region that is to be hardened. To obtain maximum hardness, the quenching should be done quickly and should begin while the heat is still at the critical point. The reheating and subsequent cooling should be done more slowly to provide an opportunity for the metal to re-adjust itself in such a manner as to relieve the internal stresses that cause brittleness, which are brought into existence by the sudden quenching. The proper rate of reheating, in effect, anneals the steel, reducing its brittleness and toughening it without materially reducing the hardness that is obtained through quenching.

Control Is Not Difficult

In practice it has not been difficult to control the temperature of both heating and drawing within a range of 25 deg., and with 50 deg. as the widest permissible latitude. It is rarely found when checking with the pyrometer that the range is as much as 25 deg., after an operator is properly trained. The pyrometer gage is graduated to 2,000 deg. in increments of 25 deg., and half divisions are easily read, so that there is no difficulty in detecting even small variations. Since uniform heating and quenching are considered to be important elements in the success of the heat treating, these features are given preferred attention by the supervisory forces as well as by the foremen. Every effort is made and frequent checks are required to insure that the variations in practice are kept within the smallest practicable range.

Laboratory studies have disclosed that the metal is affected for only a limited depth, averaging about $\frac{1}{4}$ in. below the surface, if the treating has been done properly. The Brinell hardness of an average open-hearth rail is about 260. After treatment, this hardness is increased to about 325, although specimens treated in the laboratory have shown a hardness as high as 360, owing to the fact that the smaller section responds to the treatment better than if associated with a larger volume of metal, as in the head of the rail.

Laboratory specimens show an average increase of 50 per cent in the elastic limit, from 70,000 to 106,000 lb., while the ultimate tensile strength is raised from 128,000 lb. to 198,000 lb. The elongation is reduced from 13.5 per cent to 7 per cent and the reduction in area is increased from 17 per cent to 23.6 per cent.

Why the Rail Is Treated in the Track

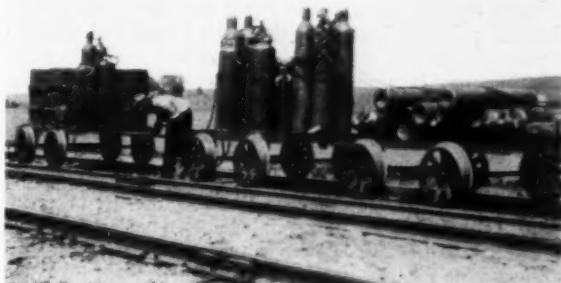
The question has been raised as to why the treating is not done at the rail mill, or at least before the rails are laid in the track. The answer is that facilities and methods at the mill do not lend themselves to this type of work, which probably would interfere seriously with the mill program. Likewise, if attempted at some central point, the cost of handling and reshipping the rail would be prohibitive. An effort was made to do the treating after the rail was unloaded along the track and it was found that the gas requirements increased 100 per cent, while the necessity of turning the rails up workway and the fact that the number of heating, quenching and reheating operations was doubled, slowed down the progress to such an extent that the cost was 55 cents a joint, as compared with 35 cents after the rails are laid. Furthermore, it was practically impossible to do a uniform

job of chamfering, while the amount of grinding was also nearly doubled.

As an example of the effect of treatment, the rail treated near Cedar Falls, Wash., in 1929, included a 13 deg. curve laid with the 100-lb. section. The normal life of the rail on this curve is two years. A recent inspection showed that the treated area has worn to some extent, but there are no signs of flowing, even in the low rail. In comparison, flowing is so pronounced outside of this area that the remainder of the head of the low rail now has a width of about $3\frac{1}{4}$ in.

An interesting byproduct of the process is the occasional discovery of small internal horizontal fissures. These are easily detected because the expansion of the metal overlying a fissure causes it to bulge slightly, so that the area above the fissure comes to a red heat more quickly than the surrounding metal. Such joints are treated in the usual manner, but they are carefully marked and their location is recorded. As soon thereafter as is practicable, a welding outfit is sent to cut out the defective section and weld in new metal. No case has been encountered which could not be repaired.

It is not claimed that this form of heat treatment will eliminate rail batter. The practice is so recent that the ultimate results can only be estimated. There is ample evidence, however, that the progress of the joint batter is being retarded to such an extent that, so far as can be determined, the process has already proved its economic worth. With the later development of methods



The Gas Cylinders and Water Barrels Are Carried on Push Cars

and the technic of applying them, many of the undesirable and discouraging features of the early period have been overcome, until it is now believed that further improvements will be in the nature of refinements of the practically standardized methods.

What have been the tangible results? Flow of metal within the treated area apparently has ceased. Wear, except on the high rail on curves, cannot be detected visually. Likewise it requires the use of a feeler gage to detect any depression in the running surface in even the oldest heat-treated joints. Those that can be measured do not exceed 0.008 in. on tangents, while many of them are as little as 0.004 in. These joints were not treated, however, until the rail had been in service for several months and it is believed that the depressions existed at the time of the treatment. In any event, other rails laid at the same time and under comparable traffic have already required the reconditioning of some of the joints.

All of the development and experimental work in connection with the process has been carried out by the maintenance-of-way staff of the Milwaukee. M. D. Bowen, superintendent of welding, has supervised the work and has had active charge from the start.

Brush or Spray Painting?*

Report of an investigation of the relative cost, durability and protective value of coatings applied by the two processes

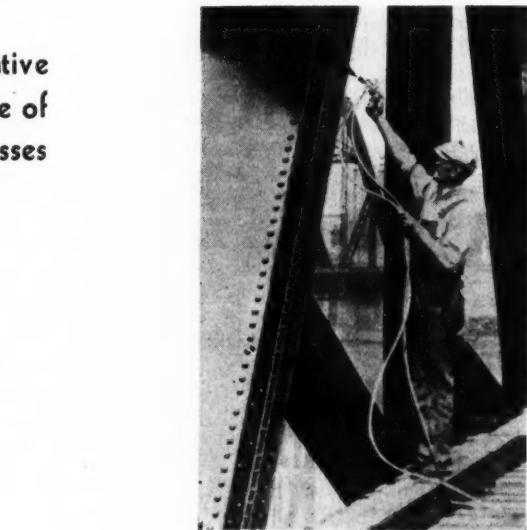
DURING the period immediately following the armistice, the acute shortage of skilled labor in the painting industry and the lack of an adequate supply of brushes due to an extreme curtailment of the stock of bristles encouraged the rapid development of mechanical painting. Within a short time results indicated that spray painting was indispensable for industrial production, and the obvious benefits and efficiency secured in this field suggested the use of similar methods for the painting of buildings and structures. During the experimental period the machines devised for work of this nature were rather crude and their use was restricted to certain well defined limits.

Many modifications and refinements have since been made and many accessories have been added to spray painting equipment, with the result that the scope of mechanical painting has gradually been broadened until at present practically all phases of building and structures painting may be undertaken in this manner. However, the perfection of a machine or process from the standpoint of laboratory experiments does not make that machine or process practicable from a commercial standpoint. So, in this instance the cost of application, durability and protective value must determine the practicability, economy and commercial value of spray painting.

The committee was chiefly interested in studying this subject as it applied directly to the railroads of this continent, and, through the very able cooperation of many manufacturers of paint, brushes and paint-spray equipment many valuable data were made available. Information from the railroads was secured principally through the use of a brief questionnaire which was submitted to 51 different roads and to which replies were received from 34 with a total mileage of 107,052. In addition, some data were supplied by members of the committee so that the report is representative of 38 railroads with a combined mileage of 119,911.

Extent of Use of Spray-Painting

Of the 38 roads, three with a total of 2,213 miles of line, reported no use of spray equipment, seven roads, with a total of 33,370 miles of line, reported experimental use, while the roads reporting some degree of practical use are as follows:



Per Cent of Painting Program	Number of Roads
Less than 25 per cent.....	3
25 to 50 per cent.....	7
50 to 75 per cent.....	3
Over 75 per cent.....	3

One large system reported that 85 to 90 per cent of its large bridges and buildings were painted by machine, while another road replied that at least 90 per cent of its entire program involved spray-painting.

Fifteen roads use division forces and two use system forces for all spray painting. One road has a system force for all bridge painting while the spraying of large buildings is carried on by division gangs. Another road has all-steel bridges, water tanks, coaling stations, and track scales painted by system forces equipped with large compressors suitable for sandblasting as well as painting while each division is equipped with small portable outfits for minor structural painting.

About half of the roads reported that no special program was prepared for spray painting, but two general methods are followed in attempting to secure the maximum utilization of equipment. The first calls for the use of large compressors which may be employed for other work during the season that painting is not being done. The chief points of objection are that a comparatively small compressor is required for spraying so that a large machine is inefficient for this type of work, and comparatively little work is available to keep a compressor busy during the winter months when painting is discontinued. The second method utilizes the spraying machines for exterior work in summer and interior work in winter; its chief advantage is that it aids in the stabilizing of forces but requires the second trip of the painting forces over the same territory.

Air Compressors

The most popular and practical portable air compressors are those operated by gasoline engines. Three railways have reported that, in addition to the gasoline-driven equipment, electric-driven compressors of $\frac{1}{4}$ -hp. to $\frac{3}{4}$ -hp., with displacements varying from 2 to 10 cu. ft. per min. are being used to advantage. Their chief use

*This comprises an advance printing in abstract of a report prepared by a committee of the American Railway Bridge and Building Association for presentation at the convention which was to have been held in October, 1931. Because this convention was postponed until October, 1932, the association has authorized the publication of this report in *Railway Engineering and Maintenance*.

The personnel of the committee is: C. Miles Burpee, chairman (D. & H.), J. E. King, vice-chairman (C. & O.), E. E. Candee (N. Y. N. H. & H.), H. Cunniff (D. & H.), L. D. Garis (C. & N. W.), E. C. Neville (C. N. R.), C. U. Smith (Harbor Terminal Director, Milwaukee, Wis.), A. G. Rask (C. St. P. M. & O.), C. D. Turley (I. C.).

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is for the interior painting of office buildings, stations, freight and store houses and miscellaneous roadway buildings where electric current is readily available. These smaller machines are especially adapted to use in small buildings or those whose electric wiring is not designed to carry heavy loads, since connections are usually made with the lighting circuits. In larger modern buildings units with one horsepower motors and larger may be used where the wiring circuits are designed to carry such loads. For small roadway buildings where electric current is not available and areas are not large, painting outfits driven by gasoline engines of from $\frac{3}{4}$ -hp. to 1½-hp. may be used with economical results.

Two-gun, gasoline-engine driven portable painting outfits mounted on hand-drawn trucks are adapted to use on larger buildings and small bridges. These outfits usually have engines of 4 to 6 hp. with displacements of from 20 to 30 cu. ft. per min. As a general rule these machines are unsuited for use on bridges where the compressor must be located at one end of the structure and air forced through a hose more than 100 ft. long to the paint container. Bridge painting frequently entails the placing of the compressor unit at some considerable distance from the point of spray application, the installation of pipe lines for the delivery of compressed air, and the simultaneous use of several pneumatic cleaning tools. For these reasons, it is necessary to provide comparatively large compressors, varying in size from 10-hp. units with displacements of 36 cu. ft. per min. to 38-hp. plants with displacements of approximately 160 cu. ft. per min.

Mountings

The type of mounting in widest use among the railways is the ordinary flat-rim three or four-wheel hand truck, which may easily be moved around the job and loaded on, or unloaded from, push or box cars with equal facility. Many of the railways use skid mountings for large units, while smaller compressors are mounted on hand trucks, and in one instance both large and small units are mounted on skids. Two companies use small compressors mounted on motor cars. A manufacturer reports that a large number of self-propelled motor-car air-compressor units have been supplied to many roads, but that these units are used only in instances where a paint gang is required to travel continually over a large territory. He recommends also that if standard compressor units are to be used in this manner they should be furnished with bases which may be mounted on push cars to be drawn by motor cars, so that the motor car is available for transportation even when the compressor unit is in service.

For painting only, the most useful size of compressor is one with a capacity ranging from 15 to 30 cu. ft. of free air per min. The use of two-gun outfits is advocated almost unanimously. However, the cleaning of steel bridges is of as much importance as the painting, and pneumatic cleaning tools require larger compressors. One railway uses two large compressors for sandblasting and painting steel work over the entire system while smaller outfits are used by division forces for other painting. In many instances the seasonal nature of the painting program makes it uneconomical to purchase equipment designed solely for painting. Hence compressors of large capacity are purchased and used for various purposes.

For some time many of the opponents of spray painting declared that the application of paint in this manner was suited to masonry, stucco and rough wooden surfaces only, and that its use on ordinary structural or

building work produced an inferior finish. During the past decade manufacturers have developed spray equipment and accessories in such variety that all forms of structural and building painting may readily be undertaken with spray equipment with every assurance of satisfaction. One of the midwestern railways has placed 19 spray-painting outfits in service within the past $3\frac{1}{2}$ years and the results have demonstrated their value. Accurate records of the work indicate that the labor cost of spray painting amounted to one-half that of brush painting. For many jobs, such as work on flat surfaces of buildings within 12 ft. of the ground, the labor cost in the case of mechanical painting amounted to only one-fourth that for brush work. Paint consumption was about the same in both instances except that when strong winds prevailed the machine consumption was slightly increased. Tests indicated that 300 sq. ft. could be covered by machine in seven minutes, while similar areas required one hour for painting by hand.

A wooden water tank of 100,000-gal. capacity was painted by machine with a consumption of 34 gal. of paint as compared with 44 gal. for hand work, and a saving of \$25 was also made in the labor costs. In instances where scaffolding was used, costs were reduced 20 per cent. Spray painting within 12 ft. of the ground is accomplished by using extension nozzles, thus eliminating scaffolds. One gun uses about 25 gal. of paint on flat surfaces in 7 hours. The paint used is of the same consistency as that applied by brush and no extra labor is required in its preparation. Guns and hose are cleaned each evening in about 15 or 20 min. time.

An eastern road reported that during the summer of 1928 four platforms and sheds were erected with roofs of 3-in. planed and matched plank, with two nailings for 9-ft. lengths, leaving open joints which absorbed a considerable quantity of paint. A total of 79,000 sq. ft. were primed with spray guns, one gallon of paint covering an average of 150 sq. ft. Good covering qualities were especially noted and the films are still intact.

Surface conditions frequently present certain problems which require very careful consideration. Representatives of three railways and a paint manufacturer declare that when a surface is badly weather-beaten and cracks are extremely large, it is almost impossible to fill them with the spray alone. If the brush and spray are used together and the primer is applied with the machine and then brushed rapidly by hand, the weather-beaten cracks may all be filled and the entire process will require very little time.

Two eastern roads reported that interior walls and ceilings of shops, storehouses and office buildings had been successfully coated with spray guns. In several instances one coat of spray paint covered as well as two brush coats so that substantial savings in labor and material resulted.

Steel Bridges and Metal Surfaces

The ordinary maintenance painting of bridges involves the removal of considerable rust and paint scale prior to the application of paint. In many instances the cost of cleaning will comprise from 35 to 80 per cent of the total cost of repainting. Prior to the introduction of pneumatic tools this was a laborious process carried on by hand with chisels and scrapers. In many instances this type of cleaning was not given very close supervision, with a consequent neglect of portions of the structure, particularly those involving difficulties and discomfort to the individuals using the cleaning tools. The development of portable air compressors made sand blasting available although the cost of this type of cleaning is

considerable. Small, light pneumatic chisels, plunger-type hammers and rotary-type steel brushes may now be employed to excellent advantage. Their use under good supervision assures a thorough cleaning of metal work at moderate cost and a considerable reduction in the physical effort required of the operators. Their use, particularly on large structures, requires a compressor of large capacity in order that several tools may be operated simultaneously with the spray guns, thus assuring that the clean metal surfaces are covered before further corrosion can take place.

Painting Costs

There is a considerable variation of opinion as to the actual costs of the two types of painting. The records of two roads show that the costs of material were the same, while six others found that material costs ran from 10 to 30 per cent higher for machine work. Practically all roads agreed that labor costs were less in the case of spray painting than with brush application. These estimates of saving in labor varied from 10 to 75 per cent and, in the majority of cases, from 30 to 40 per cent. In general, the average labor cost of spray painting is about 65 per cent of the cost of brush application. Relative costs will vary considerably with the type of work. One road found that the spray painting of bridges entailed more moving of scaffolding although this difference may be considerably reduced by the use of extension nozzles.

Few data were received concerning equipment costs. Certain roads stated that operation, interest and depreciation costs of air compressors were of minor importance and that although such charges should not be neglected it is probable that their consideration would not change the results appreciably. A western railway has found that a 4½-in. by 5-in. air compressor of 6-hp. rating consumes ½ gal. of gasoline and ¼ pt. of oil per hour. The cost of repairs and replacements, based on a 2,500-hour operation, amounted to two cents per hour. Depreciation amounted to approximately 7 cents per working hour. The average cost of moving the equipment amounted to \$10 per job.

Expressions of opinion as to relative differences in total costs show even wider variation than in labor costs. One road maintained that with the use of relatively expensive paints for bridges and buildings, increased material cost made spray painting more expensive than brush work. Another road stated that some work was 40 per cent cheaper when painted by machine.

The following cost data were taken from the regular painting records of an eastern road.

Structure: Freight house, frame construction.	
Date painted: 1926 (brush painted).	
Area: 2,920 sq. ft., first coat; 4,040 sq. ft., second coat.	
Labor cost first coat.....	\$ 43.20
8 gal. paint at \$2.20.....	17.60
Labor cost second coat.....	62.52
12 gal. paint at \$2.20.....	26.40
Total cost	\$149.72
Cost per sq. ft.	3.70 cents
Date repainted, 1931 (spray painted).	
Area: 1,825 sq. ft., first coat; 2,565 sq. ft., second coat;	
3,850 sq. ft., third coat; 355 sq. ft. of trim was painted	
two coats by hand brush.	
Labor cost first coat, 9 man-hours at 60 cents.....	\$ 5.40
5 gal. paint at \$2.20.....	11.00
Labor cost second coat, 11 man-hours at 60 cents..	6.60
8 gal. paint at \$2.20.....	17.60
Labor cost third coat, 15 man-hours at 60 cents...	9.00
11 gal. paint at \$2.20.....	24.20
16 gal. gasoline at 12 cents.....	1.92
Labor cost brushing trim, 14½ hr. at 60 cents....	8.70
2 gal. paint at \$2.20.....	4.40
Total cost	\$88.82

Cost per sq. ft..... 2.11 cents
Relative cost of spray painting as compared to brush work, 57 per cent.

Remarks: In 1926 one gal. of paint covered an average of 365 sq. ft. on the first coat and 337 sq. ft. on the second coat. Spray guns covered an average of 365 sq. ft. of surface per gal. on the first coat, 333 sq. ft. on the second coat and 350 sq. ft. on the third coat.

During the summer of 1927 a small painter gang on a division in New York state cleaned and painted a series of railway bridges. Four were cleaned and painted by hand methods, and eight were cleaned with pneumatic tools and painted with spray guns. In all instances the portions of the steel which were cleaned to bare metal received a coat of red lead and the entire structure in each instance received a coat of black graphite paint. The gang was without previous experience in spray painting and required careful instruction and supervision. A summary of the figures reported by the foreman upon the completion of the work follows:

	Weight Tons	Cost of Cleaning	Paint Gal.	Cost of Paint Labor	Total Cost	Cost Per Ton
Hand Work	511.97	\$907.02	246	\$1,068.42	\$2,434.49	\$4.75
Mechanical Work.....	513.99	486.66	159	390.25	1,153.88	2.24
Average cost of cleaning by hand, per ton.....					\$1.77	
Average cost of cleaning by machine, per ton.....					0.95	
Average cost of painting labor by hand, per ton....					2.09	
Average cost of painting labor by machine, per ton..					0.76	
Average cost of cleaning and painting by hand, per ton					4.76	
Average cost of cleaning and painting by machine, per ton					2.24	
Average amount of steel covered per gal. by brush in tons					2.08	
Average amount of steel covered per gal. by machine in tons					3.23	

During the summer of 1930 two bridges of similar general construction were cleaned and painted under the supervision of the same foreman, one by hand and brush methods and the second by machines, at the following costs:

	Weight Tons	Cost of Cleaning	Paint Gal.	Cost of Paint Labor	Total Cost	Cost Per Ton
1.	67.63	\$ 80.52	28	\$107.58	\$ 224.05	\$ 3.46
2.	463.90	664.57	159	433.23	1,500.41	3.23

A Test on a Midwestern Railway

The following data represent results of a test on a midwestern railroad.

Structure: Solid deck girder bridges.

Date: 1930.

Type: The bridges consist of through plate girders with a floor system of transverse I-beams spaced 13 in. center to center, covered with steel plates. To paint the underside of the top flanges of the I-beams and the webs and upper surfaces of the lower flanges, it was necessary to reach up through six-inch openings between the bottom flanges of the beams.

Portion spray painted: The floor system; a special short extension spray gun was used with the tubes bent in such manner as to attain the correct angle and distance from the spray head to the surface. A two-gun stock outfit was used and the work was done from scaffolds hung from the girders.

The first test was made by a representative of the manufacturer of the spray equipment who sprayed 51 beams in three hours:

Labor, 3 man-hours at 58 cents.....	\$ 1.74
6 gal. gasoline at 12 cents.....	.72
6 gal. paint at \$2.....	12.00
Total cost	\$14.46
Average cost per beam.....	.2835 cents

The second test was conducted by railroad employees with no experience in spray painting; 57 beams were painted one coat:

Labor, 5 man-hours at 58 cents.....	\$ 2.90
6 gal. gasoline at 12 cents.....	.72
5½ gal. paint at \$2.....	<u>11.00</u>
Total cost	\$14.62
Average cost per beam.....	.25.65 cents

In the third test the work was done by hand with brushes (6/0 oval, 5-in. bristle); 57 beams were painted.

Labor, 24 man-hours at 58 cents.....	\$13.92
5 gal. paint at \$2.....	10.00
Total cost	\$23.92
Average cost per beam.....	.42.0 cents

Relative cost of spray painting as compared with brush work, 64 per cent.

Remarks: The coating applied by spraying was much better than the brush work. The spray operator was inexperienced whereas the brush painters were working, perhaps, faster than usual.

Durability and Protective Value

Representatives of eight railways considered the appearance of spray painting superior to brush work. Their reasons were that spraying produces a glossier, denser, and more even film which has a very desirable stippled surface. Reports from nine other roads considered spray painting equal in appearance to brush painting. One reply stated that on new lumber, concrete, plaster and metal surfaces, mechanical painting produced a more desirable finish, while brush painting of weatherbeaten and rough lumber surfaces was more satisfactory. Eight railroads believed that spray work was inferior in appearance to brush painting because it showed laps and was not as smooth.

Considering relative durability, two railroads replied that for parts difficult of access, such as certain parts of truss bridges, spray painting was decidedly superior to brush work. For ordinary work these two roads agreed with 19 others in the opinion that paint applied by spray guns was equally as durable as that applied by brush. One railway maintained that spray painting was inferior to brush work in durability.

In discussing durability a committee member wrote as follows:

From my own observations of paint applications made on identical surfaces by both of these methods, I am of the opinion that the paint applied by the spray gun has greater durability, while there is no doubt that it presents a better appearance.

Paint which has been sprayed on a surface retains its gloss much longer than that applied by brushing. Upon close examination this is found to be due to the fact that the former has a smooth even surface, while a rougher and somewhat ridged surface is left by the brush, which allows the dust to collect more readily on the surface.

In a specific test to gather information on these points, different surfaces, such as corrugated iron, steel plate girders and V-joint tongue and grooved lumber were used, all of which had been painted previously. Considerable care was taken in the application of the paint, the surfaces were well cleaned and the same quality of material was used for both methods. Observations were made at frequent intervals over a period of two years; at the end of this time it was found that the spray applications had a better appearance and seemed to have resisted weathering better than those that were made with brushes.

A definite opinion in favor of spray painting from the standpoint of durability was expressed in *Railway Engineering and Maintenance* for October, 1930, page 460, in an article by a "Master Painter" which contains much food for thought.

The Forest Products Laboratory at Madison, Wis., established by the United States Department of Agriculture, has conducted a few tests concerning the comparative durability of brush and spray paint films. The results indicate that when the films were of equal thick-

ness they were equally durable and that the method of application does not materially affect the durability, provided that good craftsmanship is exercised during both methods of application.

In Northeastern New York a 1,300-ton deck truss bridge was painted with a red lead primer and a coat of carbon black paint during the summer of 1922. Spray guns and brushes were used for application. An inspection during the early part of August, 1931, revealed no pronounced difference in the appearance and condition of the films.

A short time later several bridges were inspected by two committeemen and another member of the association. These structures had received a thorough cleaning, patch coats of red lead primer and one full coat of black graphite paint during the summer of 1927. After a thorough inspection, the three men agreed that there was no apparent material difference in the durability of the films.

A representative of a large paint manufacturing company writes as follows:

Our experience leads us to the conclusion that brush painting is far superior on all exterior surfaces where a linseed oil paint is applied. On interior painting, if the spray work is done carefully with good workmanship, we find it is equally as durable as brush application but not superior. Our personal experience is that in finishing exterior surfaces with varnish, aluminum and many of the quick drying finishes, perfectly satisfactory results may be had with the spray method of application.

Summary and Recommendations

As a result of the investigation and study by the committee, it is apparent that:

1. Modern spray painting machines and their accessories have been developed to such a degree that types are now available for the proper application of practically all types and weights of paints adapted to the upkeep painting of all railway buildings, bridges and structures.

2. In practically all instances the rate of application by machines is much greater than the rate of hand brush painting. Labor costs of application have been materially reduced by the use of spray equipment.

3. The loss of material from atomization, even in exposed locations, is trifling. In many instances the mechanical painting of bridges and steel structures has required less paint than brush methods. Experienced craftsmanship and proper equipment for the spray painting of buildings have reduced the consumption of paint to less than 6 per cent in excess of that used in brush work on similar surfaces. Other instances are recorded where similar exterior surfaces have been painted with similar quantities of the same paint by both methods. Many instances have been noted where one spray coat covered as well as two brush coats on interior work.

4. The finished appearance of spray painting is equal to and in many instances surpasses the appearance of brush work.

5. The use of suitable spray-painting equipment operated by experienced craftsmen results in the application of a more even, denser and glossier film than that produced by brush methods. Such a film is believed to be more resistant to the elements and of more protective value. The durability of sprayed films is at least equal to and in some instances surpasses that of films that have been applied by hand.

6. The cost of painting buildings, bridges and other structures has been very materially reduced by the use of spray painting machines.

Therefore, the spray painting of bridges, buildings and structures is recommended as of practicable, economic and commercial value to the railroads of this continent.

Maintenance Safety Problem Has Many Angles*

Enthusiasm, attention to details, stabilization of forces, and meetings given as important in reducing injuries

By H. W. WAGNER

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THE PREVENTION of accidents to employees in the maintenance of way and structures department involves the providing of safe working conditions, safe tools and equipment, and the enforcement of proper instructions regarding safe methods of work, including the safe use of tools and equipment.

Personal injuries to employees in maintenance work are usually more numerous per man-hour worked than in other departments because a larger portion of such employees are classed as common laborers; because a larger labor turnover interferes with the training of the men; because such employees are often men who do not realize that accidents are preventable, and who have not been taught that to work safely means more to themselves than to anyone else; and because a larger proportion of the work is carried on out of doors and under all conditions of weather.

In general, railroad managements have been liberal in expenditures to improve working conditions from the standpoint of safety, but there are some hazardous physical conditions which cannot economically be avoided and in such instances supervisors must be particularly careful to comply with all rules of safety and repeatedly warn all workmen to be cautious while working. Bad weather will often cause poor working conditions, making it advisable to suspend work until better weather removes these hazards. Supervisors must be continually watchful to avoid working unnecessarily under these conditions.

Power Equipment Reduces Injuries

Most railroads are now well equipped with safe tools and equipment. Heavy material is now handled largely by machinery and this should result in a distinct reduction of injuries. Cranes are now available in a wide range of sizes so that it is practicable to use this equipment much more extensively than heretofore. Manufacturers of maintenance of way equipment of all kinds have made commendable progress in recent years in the improvement of such equipment and in the development of new machines for handling many operations that heretofore have been handled by hand labor. In a rail-laying organization supplied with modern equipment, spikes are pulled and driven, ties are added, bolt nuts are removed and placed, the old rail is removed and new rail laid, and track is surfaced, all by machines. Practically all new material is unloaded and the old material loaded by machinery.

It is true that power equipment introduces some new problems in safety, but the net result of its increasing

use in maintenance work has been a reduction in personal injuries, and undoubtedly there will be a considerable further reduction. The problem of providing and maintaining safe tools and equipment involves close attention to details as many minor and some serious injuries may result from minor unsafe conditions that are not noticed readily. It is especially essential to construct new power equipment with every protection reasonably possible, and small hand tools must be watched closely to avoid their use after they become worn to an unsafe condition. Track chisels are particularly hazardous and should always be provided with a rubber guard to prevent chips from flying off.

Unsafe Practices Cause Most Accidents

At the inception of the safety movement, the unsafe conditions, tools and equipment were given greatest consideration and have gradually been corrected until it is now found that the majority of accidents are not due to any of the above causes but to unsafe practices. The enforcement of proper instructions regarding safe practices or methods of work is the major problem in maintenance work and is largely a problem of individual instruction. Thus we meet the personal equation in safety, which is the most difficult of all to handle. The correction of unsafe practices requires the enthusiasm and cooperation of all officers and supervisors, and to be effective must convince each employee that working safely and persuading those about him to do so is to his personal interest.

Another factor of importance in safety training and instruction is the problem of labor turnover, this problem being particularly acute in extra gangs on track work. There is an increasing tendency to stabilize railroad maintenance work and this tendency should receive hearty co-operation and encouragement. Many of our old notions that have aggravated this situation will not stand the acid test of close analysis, and we should not permit personal prejudices in favor of such ideas to interfere with this commendable effort to stabilize maintenance employment.

Under a given set of general conditions, the success of our efforts in individual safety training and instruction will vary directly in proportion to our thoroughness in handling details of the problem. Efforts in the maintenance of way department of the Santa Fe in this direction, between 1923 and 1930, have resulted in a reduction of 66% per cent in the number of employees killed and 50 per cent in the number of employees injured while on duty, as reported to the Interstate Commerce Commission, and it may be of interest to discuss some of the Santa Fe practices in this work.

*Abstract of a paper presented before the annual meeting of the Safety Section, American Railway Association, at Chicago.

Three forms of safety meetings are held, namely, the division general meeting, the shop mechanical or stores department meeting, and local meetings at outlying points. The division general meeting is held bi-monthly and is attended by the members of the division safety committee and all others who may be in position to attend. The committee is usually composed of the division superintendent, members of his official staff, representatives of station, shop, track, bridge and building, train and engine, signal and clerical forces. Each committeeman answers the roll call by stating the number of persons with whom he has talked concerning safety since the last meeting. Each member, as well as any visitor, is then invited to report any items for the furtherance of safety which may have been brought to his attention.

Members, however, are urged to report unsafe conditions or practices as soon as discovered so that they may be reported at the meeting as having been corrected. Each item reported is included in the minutes of the meeting which are sent to the superintendent of safety, and each item must be carried forward to the next meeting until corrected or until reasons for not doing so have been approved. Safety supervisors usually attend these meetings and, in addition to giving local committees the benefit of happenings on other parts of the system, act as personal contacts between the division committee and the superintendent of safety. Local meetings are held from time to time at outside points where they are justified by the number of employees, and the general public is often invited to these meetings.

The Maintenance Organization

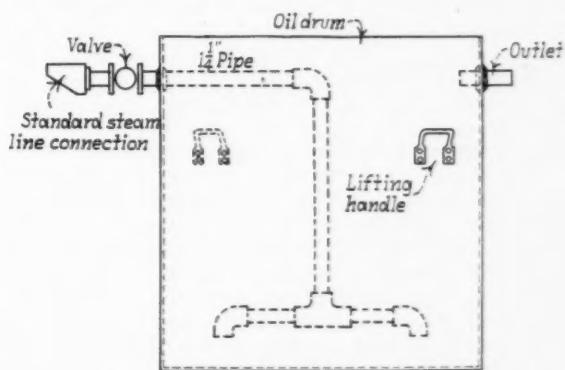
In addition to these safety meetings, the employees in the maintenance of way and structures department have an organization which meets quarterly with the division officers and discusses with them ways and means of promoting the welfare of employees, improving tools and methods of doing work, and other matters of mutual interest, including safety. The safety supervisor is usually present at these meetings and gives a talk of special interest to maintenance men. These meetings are held at the same place and on the same day as the division safety meetings as often as possible so that the maintenance men can attend the division safety meetings at least once each year.

The best way of approaching men in regard to safety is to sell it to them on the strength of the benefits to be derived by practicing safety, and the best results are obtained by exercising patience. All supervisors must be enthusiastic in talking and practicing safety. This enthusiasm must start at the top and proceed downward, gaining the wholehearted support and active interest of each officer in succession until the gang foreman has become imbued with the idea of safety to such an extent that he preaches it to his men. All of his superiors must at the same time be alert to see that all safety rules are obeyed, that tools, appliances and conditions are safe, and that no unsafe practices are permitted. Some men will be less enthusiastic toward a safety campaign than others, and in rare cases it may be necessary to resort to discipline to correct a man's viewpoint and to impress upon him that the management is in earnest in requiring men to study and practice safety. The greatest incentive toward the safety habit is the realization of the possible consequences of a careless act. Sometimes best results can be obtained by interesting a man's family and dependents in his welfare, bringing home to all the results that might follow an accident due to indifference or carelessness on the part of the father or his associates.

How One Road Melts Snow in Its Coach Yards

A N ingenious device for melting snow around coach yard and other platforms was developed and used successfully during the blizzard of March, 1931, by the Pennsylvania at its Twelfth Street coach yard, Chicago. With this device snow may be melted rapidly on a large scale by utilizing steam from the coach-heating lines.

The equipment necessary consists of a steel oil barrel cut off a short distance below the top, an assembly of pipes and connections for conveying the steam to the bottom of the drum, and an outlet pipe near the top for permitting the escape of the water. The steam is admitted at the top of the drum and conveyed to the bottom through a 1 1/4-in. cast iron pipe and is released through a double outlet. The outside end of the pipe is equipped with a steam connection so that standard 12-ft. sections of steam line may be used in the operation. A valve is located next to the connection in order that the amount of steam admitted may be controlled. The 1 1/4-in. pipe extends through a hole in the barrel about 5 in. below the top and is welded to the wall of the barrel, as



A Section Through the Snow-Melting Device

is the short 3/4-in. outlet pipe. When in operation, the line conveying steam to the melter is attached to the steam line between the coaches by means of a triple connection that does not interfere with the heating of the coaches.

It has been found that this device melts snow with such rapidity that three men with shovels are required to operate it at capacity. When the snow on a section of the platform has been cleared, the drum is emptied of water and removed to a new location. The melted snow is allowed to drain away through the catch basins with which the platforms in the coach yards are equipped. A pair of handles are riveted to the sides of the tank to facilitate the handling of the drum when it is being moved from place to place.

At certain points about the coach yard no steam is available and, in order to overcome this difficulty, a tractor equipped with a bulldozer is utilized to pile the snow at points where the melter may be brought into use.

Two of these snow melters were utilized during the March, 1931, blizzard at the Chicago coach yards, and their use met with such success that it is planned to increase the number of units available at this yard. At no time during the March blizzard did the temperature become extremely low and there is therefore some uncertainty as to what the performance of this melter would be under such temperatures.

Winter No Bar to Concrete Work

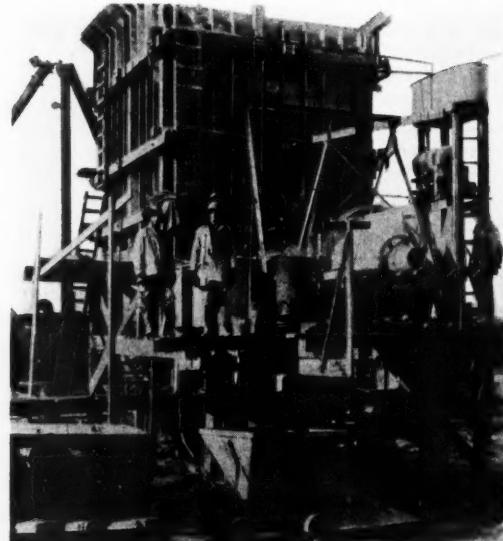
Thoroughly tried methods of heating the aggregates and protecting the material during hardening leave no grounds for apprehension concerning the desired strength and durability

By H. L. FLODIN
Portland Cement Association, Chicago

THE PRACTICE of placing concrete in winter has grown from year to year until today concrete work is done at any time of the year, regardless of the season. The economies to be realized by avoiding seasons of maximum traffic, by maintaining an experienced organization, by avoiding periods of high water and by advancing the completion date to expedite progress on other items of the general construction program will, in most cases, far exceed the added expense for the heating and protection that are necessary in winter work.

Experience has shown that concrete of good quality can be produced successfully even under the severe conditions that prevail in Northern Canada where temperatures as low as 60 deg. F. below zero have been recorded while work was in progress. However, in the greater portion of the United States, there are relatively few days when the temperature is much below freezing. In many localities, there are long periods in the early and late winter when temperatures considerably above freezing prevail. During much of the so-called winter season, then, conditions for construction work are better than during hot weather.

The process by which portland cement sets and concrete hardens is a chemical reaction between the cement and water rather than a drying-out process. Like nearly all other chemical reactions, the process is slower at low temperatures and faster at high temperatures. At temperatures below freezing, the uncombined water in concrete forms ice crystals and hardening of the concrete practically stops. Even at temperatures between freezing and 50 deg. F., the process is relatively slow. Most specifications, therefore, require that the concrete shall

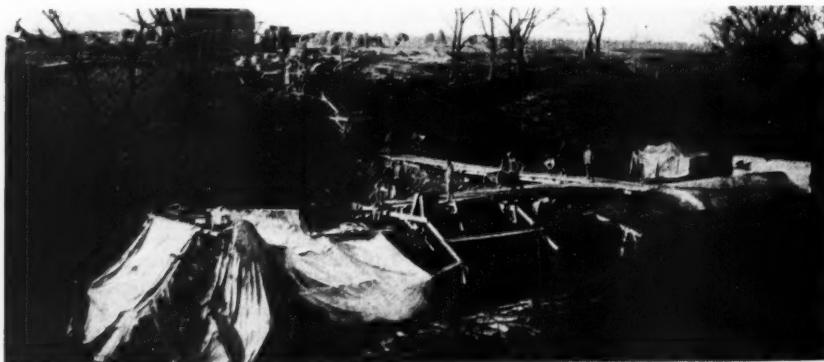


A Steam Heated Aggregate Bin and Water Tank

have a temperature above 50 deg. F. when placed and shall be kept above 50 deg. for at least three days. Higher temperatures than this are desirable as a larger proportion of the potential strength will be developed by the concrete. With higher temperatures, however, loss of water by drying out is more rapid, so it is essential to prevent evaporation from the concrete or supply moisture to replace that lost by evaporation. This precaution is too often neglected in winter concrete work.

To secure these temperatures, it is necessary at times to heat some of the materials. Heating the mixing water is most convenient, and for a large part of the winter season heating the mixing water only and then protecting the concrete after placing will be sufficient. The specific heat of water is more than four times the specific heat of the usual aggregates; in other words, a given weight of water holds more than four times as many heat units as the same weight of aggregate at the same temperature.

Mixing water may be heated in various ways. Live steam may be injected into the water in an auxiliary tank or barrel or the water may pass through a coil in a salamander having a hot fire. Oil-burning water heaters are also available. At temperatures below freezing, it is not advisable to heat the water above 160 to 180



Protecting an Arch Culvert Built in the Winter Near Chillicothe, Ohio

deg. F., on account of the vapor that would be given off and which would condense and freeze on equipment. Oil-burning torches so attached to the mixer as to direct the blast into the drum will serve for heating the batch during the time of mixing. To prevent loss of the heat, the mixer should be placed where strong winds will not blow directly into the drum, or a protective wall should be built on the north side of the mixer to shut off winds.

Heating Aggregates

Heating the water only is not sufficient when temperatures are below freezing. It requires a large number of heat units to melt any ice that has formed in the aggregate, and the materials are not in the mixer long enough to permit thorough thawing and assure a separation of aggregates that have been frozen together. Aggregates may be heated in various ways. Where steam is available, steam jets may be placed in the stock piles. Covering the stock piles with tarpaulins will prevent the escape of much of the steam and will assist in retaining the heat. A grill of pipes placed on the ground and connected to a steam supply is also effective; the aggregates are placed on the grill and covered with tarpaulins. Where overhead batching bins are used, steam coils placed in the bins are often sufficient.

Many specifications require that the maximum temperature of fresh concrete shall not exceed 120 deg. F.; others permit temperatures up to 140 deg. F. Recent tests by the Minnesota Department of Highways indicate that these high temperatures appreciably reduce the strength. Tests made at 28 days on concrete placed at 100 deg. F. showed a compressive strength about 16 per cent lower than similar concrete placed at 70 deg. F., while at 130 deg. F., the reduction was approximately 33 per cent.

Similar results were obtained in transverse tests. In these tests, the mix was 1:2.07:3.12 by weight, with about 4½-in. slump. The curing temperature was 70 deg. F. Part of the loss in strength is accounted for by the need for additional water in the warmer batches to maintain the desired consistency. When no water was added, the loss in strength for concrete placed at 130 deg. F. was approximately 20 per cent.

While this series of tests was rather limited, it does indicate that concrete should not be placed too hot. In out-door work, the loss of heat before the cement sets would be greater than in the laboratory tests but the tests indicate that temperatures above 100 deg. F. should not be permitted.

Protection of Concrete

Protection of the concrete after it is placed is just as important as heating the materials. When portland cement sets considerable heat is generated and the retention of some of this heat is often sufficient protection. In mild weather, the form work itself and a covering of tarpaulins over top surfaces may be sufficient protection. The hanging of tarpaulins over the form work gives further protection as the air space between the forms and the tarpaulin is a fairly good insulator. In colder weather, tarpaulins may be attached to a light frame built over the forms, leaving enough space for the placing of salamanders and the circulation of the warm air. Where the expense is warranted, the structure may be housed in by a frame and wood sheathing, covered with paper or tarpaulins.

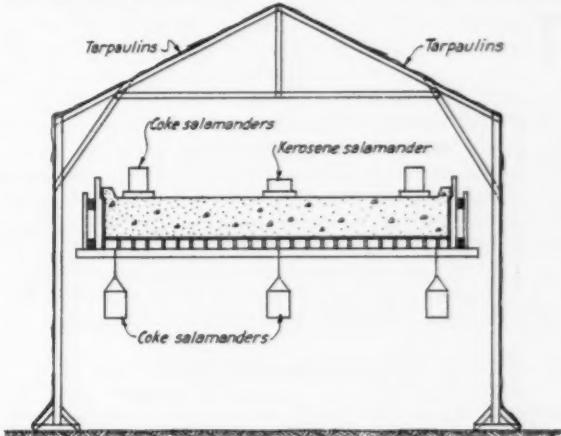
Salamanders should not be placed so close to any part of the concrete as to injure it by excessive heat or rapid drying. It is equally important not to place them too

near the wood forms on account of the danger of fire. Incidentally, oil-burning salamanders are available, as well as those burning coke. The ends of walls and the corners of structures are more subject to freezing than other parts, on account of the large area of exposure. Extra salamanders should be placed at these points.

An effective protection for concrete work done during the winter was provided on the railway grade separation project completed this year at Sixteenth Street and Stewart Avenue, Chicago, by the Chicago, Burlington & Quincy, the Baltimore & Ohio Chicago Terminal, the Chicago & North Western and the Pennsylvania. The work had been in progress during two winters. The protection used on some of the long span structures is shown in the drawing. Wooden frames covered with tarpaulins were supported on the form work. The frames and tarpaulins extended down the sides to the ground, completely enclosing the space below the slab. As soon as the concreting of a span had been completed, the structure was completely enclosed. Coke salamanders were suspended about four feet below the forms and both coke and kerosene salamanders were placed above the slab. While outside temperatures as low as zero were encountered, the temperature inside the enclosure was maintained at 50 deg. F. or above.

Use of Chemicals

Certain salts and chemicals are available as admixtures, which have the property of lowering the freezing temperature or of accelerating the process of setting and hardening. Such materials should be employed only



Method of Protecting Reinforced Concrete Slabs in Grade Separation Work at Chicago

in strict accordance with the instructions issued for their use and with a thorough knowledge of their limitations. It must be borne in mind that their use in excess of certain proportions results in a loss of strength, as shown by tests and that use in legitimate proportions does not warrant a disregard of good practice for the protection of the concrete. For example, calcium chloride used as an accelerator may reduce the time during which protection of the concrete is required, but even where it is used, early protection is necessary. The calcium chloride crystals must be dissolved in water before putting in the mixer. The best method is to make a solution of known concentration and use the desired quantity for each batch. About two per cent by weight of the cement is most satisfactory. Preliminary tests are advisable to determine the exact effect on the particular brand of cement to be used and the time that protection must be provided.



Reservoir
Supplies Have
Not Been
Entirely
Replenished

Effects of Drought Linger

Review of extent and intensity of 1930 dry spell discloses unprecedented depletion of water supplies

By C. R. KNOWLES

Superintendent of Water Service, Illinois Central, Chicago

THE DROUGHT of 1930, considered in all its details, was the most severe ever experienced in the United States. Previous outstanding droughts on record in this country were those of 1881, 1894, 1901, 1911, 1916 and 1924. The drought of 1881 was of comparatively short duration, June being very dry in the Southwest and July and August in the central valleys and in the East. The 1894 drought was confined largely to the central valleys and to the Northwest. In 1901 the central valleys, particularly the corn belt, suffered most. In the 1911 drought the greatest deficiencies in precipitation occurred early in the season. Both the 1916 and 1924 droughts covered comparatively small areas.

Not Confined to 1930

While the recent drought is generally referred to as the 1930 drought, it really began in the early part of December, 1929, although it did not become acute until early in the spring of 1930. The decline in precipitation over the country began in February, 1930, and in July it was 37 per cent below normal, being 35 per cent below normal in August. October showed an increase in rainfall of 12 per cent above normal and November an increase of 17 per cent. In some of the states most affected by the drought the rains were from 25 per cent to 50 per cent of normal in October and from 48 per cent to 77 per cent of normal in November. The precipitation in December was only 50 per cent of normal for the country as a whole, and in some states the precipitation in December ran as low as 32 to 42 per cent of normal, making it the driest month of the year.

Maryland, West Virginia, Virginia and Kentucky were relatively the driest states, with a rainfall of 56, 59, 60 and 61 per cent of normal for the calendar year,

and from 20 to 30 per cent below any previous low record.

The six-month period from March to August, inclusive, was the driest on record in Missouri, Illinois, Indiana, Ohio, Kentucky, West Virginia, Virginia, Maryland and Pennsylvania. The rainfall in these nine states as a whole during this period was only 59 per cent of normal. This figure, however, does not represent the full extent of the drought in certain of these states, as there was relatively much more rain in the northern sections of Ohio, Indiana and Illinois with a correspondingly greater deficiency in sections nearer the Ohio river. Arkansas was affected most, with only one-third of its normal precipitation during the summer months, while Kentucky, with a rainfall of only 44 per cent of normal, was hit almost as hard. The precipitation in Mississippi was 47 per cent of normal while in Maryland and Delaware it was 48 per cent.

Aggravated by High Temperatures

The drought was greatly aggravated by the abnormally high temperatures that prevailed in the Southwest about the middle of June and spread to the Missouri and lower Mississippi River valleys in the early part of July and to the Ohio and Potomac River valleys by the middle part of July, continuing throughout August. High temperatures not only prevailed during this time but continued over an unusually long period. Temperatures of 100 deg. or higher were reported in 24 states and for periods varying from 20 to 100 days. Texas reported 111 days with temperatures in excess of 100, and in the central section of the country where the deficiency in rainfall was the greatest, the record of days with temperatures in excess of 100 was as follows: Arkansas, 77 days; Mississippi, 51 days; Missouri, 50 days; Tennessee, 48 days; Kentucky, 41 days; Illinois and Virginia, 39 days each; West Virginia, 37 days;

*Abstract of a paper presented before a group meeting of the Western Society of Engineers, Chicago, on November 10.

Indiana, 28 days; Maryland, 27 days; Ohio, 23 days; Pennsylvania, 20 days.

As would be expected, the deficiencies in rainfall materially affected flowing streams, both as to the quantity and quality of the water. Detailed records are not available as to the effect of the drought on stream flow but there is no doubt that new low records were established over a large part of the country. The Potomac river showed the lowest mean monthly flow on record when it reached a low of 706 second-feet in October, 1930.

Naturally the effect of the drought on the smaller water courses became apparent first but the larger streams were also soon affected materially. Many of the small streams became completely dry, and in other cases the water was so badly polluted that it was unfit for use.

An experience with a railway water supply on a small stream known as Pond river in Kentucky affords an illustration of the effect of stream pollution during low flow. This stream became so badly polluted with sulphuric acid from mine wastes that it was necessary to abandon the supply entirely. The sulphuric acid content of the water at one time was 150 grains per gallon.

The hardness of water in the larger streams also showed a marked increase. The acidity of the water in the Monongahela river during the extreme low flow caused by the drought was greater than that shown by a previous record and caused a great deal of trouble in the operation of purification plants. The flow in the Appomattox river was so low that the tides carried the salt to a point many miles above any previous record. The same was true of the Mississippi river where, during the low stage of the river, salt was present in the water several miles above New Orleans which is 90 miles from the Gulf of Mexico.

The total hardness of the Ohio River water at Cincinnati, Ohio, increased from an average of about 100 parts a million to 232 parts a million in December, 1930. The hardness of the Scioto River water at Columbus, Ohio, rose to 375 parts a million. The salt content in the water of the Susquehanna river increased to such an extent that it became unfit for use at Havre de Grace, Md., and Prairie Point. Ordinarily the salt content of Susquehanna River water at these places is from 7 to 8 parts a million, but it increased to a maximum salt content of 885 parts a million in December.

Ground Water Supplies

Ground water supplies were affected to a less extent than surface supplies but there was serious depletion of ground water, particularly with reference to wells and springs. Deep drilled wells are not affected seriously by droughts as a rule, for they extend well below the water table and are supplied by sand beds or underground reservoirs with capacities greatly in excess of normal demands. However, there was a very noticeable increase in the hardness of the water from the deeper wells. Shallow wells rarely extend much below the normal water table, and their source of supply naturally decreases as the water table is lowered.

Springs are more sensitive to drought conditions than shallow wells because their source of supply is the overflow from the underground reservoirs. As a result, they are the first to show the effect of rainfall or drought. Streams are also affected by fluctuations in the underground water table, owing to the fact that they are dependent upon springs for a portion of their flow.

The experience of the Illinois Central during the drought was typical of that of most of the railroads in the drought area. This company operates 5,856 miles

of road in the area affected by the drought. Water for locomotives in this area is provided by 286 water stations, 123 of which are supplied from wells, 109 from streams and 54 from lakes or reservoirs.

Greatest Effect on Surface Supplies

The most severe effect of the drought was on surface supplies, although ground water supplies were also affected to a certain extent. Actual shortages occurred at 13 water stations. Two of these stations were supplied by hauling water; 3 cars daily were hauled to one station for a period of 140 days, while the other station was supplied by hauling 3 cars twice a week for a period of 110 days. It was found possible to "run" four of the stations without reduction of tonnage or other serious inconvenience and they were discontinued for the duration of the drought. At two other stations the supply was obtained temporarily from city supplies. The five other stations involved did not fail completely, and it was possible to conserve the supply throughout the drought by restricting the use of water.

The low stage of water in streams affected the quality of the water materially, with the result that some of the water supplies became highly corrosive. This was particularly true of streams in coal-mining territory, which receive waste from the mines. It was also true to a lesser degree where the streams carry sewage and other wastes. The condition of the water was watched very carefully, and corrective treatment was applied promptly as required. There was no suspension of train operation because of the drought, but there was some increase in locomotive expense due to a certain amount of leakage which could not be avoided. However, apparently, there has been no permanent damage to the boilers of locomotives in the affected territories.

The shortage of municipal supplies was fully as serious as in the case of railroad supplies, and in a number of instances the railroad was able to relieve local situations by furnishing water from its own supplies. From August to December, inclusive, the Illinois Central furnished to municipalities, other railroads and mines a total of 1,805 tank cars of water, or approximately 17,200,000 gal.

What Can Be Done?

It is too early to make recommendations as to what action, if any, can be taken to prevent a recurrence of the conditions which have prevailed for the last year. It is difficult to say whether the shortages that occurred were due entirely to unusual conditions prevailing through 1930 or in part to deficient factors of safety in water supplies. The drought has had a marked effect on ground water supplies, especially on springs and shallow wells, and there have been a noticeable lowering of the water table and increased pumping heads in many wells. In the absence of adequate data on stream flow, it is impossible to make either a definite comparison with past years or a prediction as to the future. The drought of 1930, however, emphasizes the importance and necessity of establishing increased factors in estimating the safe capacity of impounding reservoirs.

Although we are now well toward the end of 1931 and the drought has been broken, its effect is still apparent in the quality of the water and in the necessity for restricting its use at certain points. The needed supplies in impounding reservoirs have not yet been entirely replenished, and it remains to be seen whether or not precipitation through the winter will be sufficient to safeguard these supplies against further shortages.

Maintenance Safety—Where Does Your Road Rank?

Convenient comparison made possible by new tabulation on basis of National Safety Council grouping

HOW does the safety performance of the maintenance of way and structures department of your road compare with that of other roads? Heretofore, it has not been possible to make such comparisons readily, because little effort has been made to segregate the casualty ratios by departments in a form that would be convenient for this purpose. In the belief that such a compilation will afford an interesting as well as instructive means of comparison, *Railway Engineering and Maintenance* presents the accompanying tabulation, in which Class I railroads of the United States are listed according to the safety performances of their maintenance of way and structures departments in 1930. The

bulletin and have been rearranged and simplified in order better to serve the purpose.

The significant feature of this tabulation is the wide range covered by the casualty rates in each table, the

Group A

(100,000,000 or more man-hours)

Rank of Maint. Dept.	Railroad	Casualties Per Million Man-hours						
		Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	Killed	Injured	Total Casualty Rate*
1	U. P. Sys.	7	62	69	28,810	.24	2,15	2.39
2	C. & N. W. Ry.	5	67	72	24,748	.20	2,71	2.91
3	Penna. Cent.	4	62	66	21,701	.18	2,86	3.04
4	C. & N. W. Sys.	7	109	116	29,107	.24	3,74	3.98
5	Penna. Sys.	17	318	335	71,126	.24	4,47	4.71
6	C. M. St. P. & P.	10	91	101	20,523	.49	4,43	4.92
7	Penna. East.	8	128	136	24,992	.16	5,12	5.28
8	Sou. Sys.	2	176	178	33,031	.06	5,33	5.39
9	N. Y. C. Sys.	25	375	400	69,508	.36	5,40	5.76
10	Sou. Ry. Sys.	2	171	173	29,994	.07	5,70	5.77
11	N. Y. C. Co.	13	235	248	41,583	.31	5,65	5.96
12	B. & O. Sys.	5	160	165	24,451	.20	6,54	6.74
13	B. & O. R. R.	5	157	162	23,964	.21	6,55	6.76
14	N. Y. C. East.	8	175	183	26,576	.30	6,58	6.88
15	R. I. Sys.	2	172	174	22,085	.09	7,79	7.88
16	C. B. & Q. R. R.	6	193	199	23,628	.25	8,17	8.42
17	M. P. Sys.	8	264	272	32,228	.25	8,19	8.44
18	L. & N.	6	198	204	21,824	.27	9,07	9.34
19	S. P. (Pac. Sys.)	12	310	322	33,796	.36	9,17	9.53
20	Burl. Lines	6	278	284	27,584	.22	10,08	10.30
21	C. & O. Sys.	11	300	311	25,800	.43	11,63	12.06
22	I. C. Lines	12	328	340	26,997	.44	12,15	12.59
23	I. C. Co.	8	214	222	17,125	.47	12,50	12.97
24	A. T. & S. F.	7	477	484	29,950	.23	15,93	16.16
25	A. T. & S. F. Sys.	7	654	661	39,271	.18	16,65	16.83

*Sum of "Killed" and "Injured."

basis of comparison is the number of maintenance of way employees killed and injured during the year while on duty in train, train-service and non-train accidents per million man-hours worked. The man-hours given in these tables are those worked by the maintenance of way and structures department alone.

The classification comprises seven groups which are identical with those set up by the National Safety Council, the grouping being determined by the number of man-hours worked by all departments rather than by the maintenance of way and structures department alone. The limits of the number of man-hours worked which determine the grouping are shown at the top of each table. The figures are taken from the Accident Bulletin of the Interstate Commerce Commission for the year ending December 31, 1930. They are, however, presented in an entirely different form than found in this

Group B
(Between 50,000,000 and 100,000,000 man-hours)

Rank of Maint. Dept.	Railroad	Casualties Per Million Man-hours						
		Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	Casualties Per Million Man-hours	Total Casualty Rate*	
1	A. C. L.	4	23	27	15,393	.26	1.49	1.75
2	U. P. Co.	4	36	40	14,839	.27	2.43	2.70
3	Penna. West.	3	42	45	13,362	.22	3.14	3.36
4	N. Y. C. West.	5	42	47	12,460	.40	3.37	3.77
5	C. C. & St. L. Lines	2	47	49	10,182	.20	4.62	4.82
6	Mich. Cent.	6	55	61	8,322	.72	6.61	7.33
7	S. P. (T. & N. O.)	1	126	127	15,047	.07	8.37	8.44
8	M. P. Co.	8	209	217	24,716	.32	8.46	8.78
9	G. N.	5	128	133	15,100	.33	8.48	8.81
10	N. & W.	6	119	125	14,011	.43	8.49	8.92
11	B. & M.	5	127	132	12,877	.39	9.86	10.25
12	Erie Sys.	11	170	181	16,357	.67	10.39	11.06
13	Erie R. R. (a)	11	162	173	15,332	.71	10.56	11.27
14	N. Y. N. H. & H.	12	151	163	14,154	.85	10.67	11.52
15	C. & O.	9	236	245	20,722	.43	11.39	11.82
16	Reading (b)	4	189	193	15,161	.26	12.47	12.73
17	D. L. & W.	7	138	145	9,300	.15	14.84	15.59
18	St. L.-S. F.	1	177	178	11,026	.09	16.05	16.14
19	St. L.-S. F. Sys.	1	194	195	11,684	.09	16.60	16.69
20	N. P.	6	282	288	12,764	.47	22.09	22.56

(a) Includes Chicago & Erie.
(b) Includes Atlantic City Ry.

*Sum of "Killed" and "Injured."

disparity growing larger as the man-hours worked become smaller. The importance of this fact becomes more apparent in view of the comparability of the roads re-

Group C
(Between 20,000,000 and 50,000,000 man-hours)

Rank of Maint. Dept.	Railroad	Casualties Per Million Man-hours						
		Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	Casualties Per Million Man-hours	Total Casualty Rate*	
1	P. & L. E.	0	2	2	3,839	0	.52	.52
2	O. S. L.	2	11	11	5,441	.37	1.65	2.02
3	O. W. R. R. & N. Co.	1	10	11	4,758	.21	2.10	2.31
4	Wab. Sys.	2	45	47	7,037	.28	6.39	6.67
5	D. & H.	1	35	36	5,385	.19	6.50	6.69
6	M-K-T Lines	1	44	45	6,694	.15	6.57	6.72
7	Wab. R. R.	2	43	45	6,409	.31	6.71	7.02
8	Penna. N. Y. Zone	2	50	52	6,964	.29	7.18	7.47
9	Long Island	0	33	33	4,016	0	8.22	8.22
10	S. A. L.	6	97	103	12,450	.48	7.79	8.27
11	Bost. & Alb.	4	27	31	3,437	.16	7.86	9.02
12	Cent. of N. J.	8	46	54	5,387	.49	8.54	10.03
13	C. St. P. M. & O.	2	42	44	4,359	.46	9.64	10.10
14	Cent. of Ga.	2	33	35	3,225	.62	9.92	10.54
15	N. C. & St. L.	0	49	49	4,384	0	11.18	11.18
16	P. M.	1	56	57	4,146	.24	13.51	13.75
17	Y. & M. V.	2	81	83	5,669	.35	14.29	14.64
18	L. V.	1	153	154	8,175	.12	18.72	18.84
19	Gulf, Colo. & S. F.	0	114	114	5,576	0	20.44	20.44
20	D. & R. G. W.	2	118	120	5,252	.38	22.47	22.85
21	M. St. P. & S. St. M. (Soo Line)	0	144	144	6,298	0	22.86	22.86
22	N. Y. C. & St. L.	4	223	227	7,676	.52	29.05	29.57
23	G. T. W.	2	107	109	3,682	.54	29.06	29.60
24	T. & P.	5	247	252	8,462	.59	29.19	29.78

*Sum of "Killed" and "Injured."

garding the number of man-hours worked, although it is readily seen that the figures in these tables are not strictly comparable because of varying conditions of operation that exist on different roads and other underlying factors. However, taking these factors into con-

Group D (Between 10,000,000 and 20,000,000 man-hours)												
Rank of Maint. Dept.	Railroad	Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	Casualties Per Million Man-hours	Total Casualty Rate*	Railroad				Rank of Maint. Dept.
								Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	
1	M. & O.	0	5	5	3,037	0	1.65	1.65				G'F. & Ship Isl'd New Orls. Grt. N'n.
2	L. A. & S. L.	0	7	7	3,772	0	1.86	1.86	0	1	1	978 0 1.02 1.02
3	K. C. S.	1	12	13	2,841	.35	4.22	4.57	0	4	4	642 0 3.12 3.12
4	I.G. N.	0	19	19	3,327	0	5.71	5.71	0	1	1	628 0 3.18 3.18
5	Alton	0	27	27	3,905	0	6.91	6.91	0	4	4	1,089 0 3.67 3.67
6	N.Y.C., O. Cent. Lines	0	18	18	2,547	0	7.07	7.07	0	2	2	501 0 3.99 3.99
7	Gulf Coast Lines Sys.	0	34	34	3,848	0	8.84	8.84	0	6	6	891 0 6.73 6.73
8	Hocking Val.	1	8	9	932	1.07	8.58	9.65	0	11	12	1,060 .94 10.38 11.32
9	Gulf Coast Lines	0	31	31	3,097	0	10.01	10.01	0	12	12	953 0 12.59 12.59
10	W. P.	0	43	43	3,846	0	11.18	11.18	0	17	17	1,100 0 15.45 15.45
11	C. G. W.	0	42	42	3,706	0	11.33	11.33	0	8	9	510 1.96 15.69 17.65
12	Me. Cent.	1	55	56	3,544	.28	15.52	15.80	0	9	9	462 0 19.48 19.48
13	N. Y. Ont. & W'n.	0	32	32	1,828	0	17.51	17.51	0	20	20	954 0 20.96 20.96
14	E. J. & E.	2	82	84	4,014	.50	20.43	20.93	0	17	17	574 0 29.62 29.62
15	B. R. & P.	0	49	49	2,307	0	21.24	21.24	1	30	31	973 1.03 30.83 31.86
16	C. & E. I.	1	57	58	2,502	.40	22.78	23.18	0	30	30	916 0 32.75 32.75
17	M. & St. L.	0	47	47	1,865	0	25.20	25.20	1	64	65	1,835 .54 34.88 35.42
18	St. L. Sw. Sys.	2	156	158	5,726	.35	27.24	27.59	0	28	28	737 0 36.99 36.99
19	C. I. & L.	1	54	55	1,865	.54	28.95	29.49	0	21	21	557 0 37.70 37.70
20	W. & L. E.	2	77	79	1,899	1.03	40.55	41.60	0	79	79	1,273 0 62.06 62.06

*Sum of "Killed" and "Injured."

sideration, the tables still afford a not inaccurate medium of comparison.

In order to avoid confusion, attention should be called to the fact that in the tables are listed both individual railroads and systems of railroads, the various units of which are more or less distinct from each other. For example, the Chicago & North Western System, which is comprised of the Chicago & North Western Railway and the Chicago, St. Paul, Minneapolis & Omaha, is listed separately in Group A from the C. & N. W. Ry., both the road and the system working a total of 100,000,000 or more man-hours yearly. The C. St. P. M. & O., however, working a total of between 20,000,000 and 50,000,000 man-hours, is listed in Group C. Comparable distinction is drawn between other systems and the individual roads contained therein.

If these tables prove to be a definite contribution to the safety program of the railroads and are found to

Group E (Between 5,000,000 and 10,000,000 man-hours)												
Rank of Maint. Dept.	Railroad	Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	Casualties Per Million Man-hours	Total Casualty Rate*	Railroad				Rank of Maint. Dept.
								Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	
1	G'f. Mob. & N'n. Sys.	0	6	6	2,269	0	2.64	2.64				Tex. Mex'n.
2	Du. Mis'be. & N'n. (a)	0	7	7	2,462	0	2.84	2.84	0	0	0	Gr'n. Bay & W'n.
3	Chi. & Erie	0	8	8	1,407	0	5.69	5.69	0	2	2	San. Ant. Uv. & Gulf
4	Bess. & L'k. E'e.	0	9	9	1,392	0	6.47	6.47	0	2	2	Mo.-Ill.
5	Atl. Birm. & C'st.	0	23	23	1,498	0	15.35	15.35	0	3	3	Q'cy. Omaha & K. C.
6	Pan. & S. Fe.	0	63	63	3,745	0	16.82	16.82	0	4	4	Det. & M'kinac.
7	St. L. Sw. of Tex.	1	42	43	2,551	.39	16.46	16.85	0	5	5	Bingham & Gar.
8	Sp'k. Port. & S'tle.	0	22	22	1,291	0	17.04	17.04	0	5	5	Lke. Sup. & Ishp.
9	Cent. Verm't.	0	24	24	1,327	0	18.09	18.09	0	6	6	Utah
10	Fla. E. C'st.	1	45	46	2,447	.41	18.39	18.80	0	6	6	Ch. & Ill. Mid.
11	L'a. & Ark.	0	40	40	2,013	0	19.87	19.87	0	7	7	Det. & Tol. S. L.
12	Colo. & Sou.	0	30	30	1,482	0	20.24	20.24	0	8	8	N. J. & N. Y.
13	Ft. W'th. & Dev. City	0	43	43	1,697	0	23.34	25.34	0	9	9	P'gh. & Shawmut
14	Virginia	1	54	55	2,058	.49	26.24	26.73	0	10	10	Nev. North'n.
15	Rich. Fred. & Potomac	0	46	46	1,651	0	27.86	27.86	0	11	11	Ulster & Del.
16	Georgia	0	23	23	764	0	30.10	30.10	0	12	12	St. L. San. Fr. of Tex.
17	Rutland	0	37	37	1,159	0	31.92	31.92	0	13	13	Spokane Int'l.
18	St. L. Sw'n.	1	114	115	3,175	.31	35.91	36.22	0	14	14	Wich. F's. & S.
19	Northw'n. Pac.	0	60	60	1,610	0	37.27	37.27	0	15	15	Du. Winn. & Pac.
20	N'flk. Sou.	0	73	73	1,401	0	52.11	52.11	0	16	16	La. Ark. & Tex.

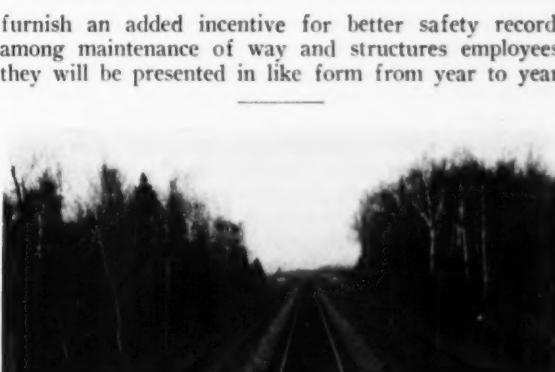
(a) Includes Duluth & Iron Range.

*Sum of "Killed" and "Injured."

Group F (Between 2,000,000 and 5,000,000 man-hours)

Rank of Maint. Dept.	Railroad	Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	Casualties Per Million Man-hours	Total Casualty Rate*	Railroad				Rank of Maint. Dept.
								Killed	Injured	Total Killed and Injured	Man-hours (Thousands)	
1	G'F. & Ship Isl'd New Orls. Grt. N'n.	0	1	1	1	978	0 1.02 1.02	1	1	1	642 0 3.12 3.12	
2	Ann Arbor	0	2	2	2	628	0 3.18 3.18	2	2	2	592 0 3.18 3.18	
3	At'l. City	0	4	4	4	1,089	0 3.67 3.67	3	3	3	891 0 6.73 6.73	
4	Peoria & E'n. (N.Y.C.)	0	2	2	2	501	0 3.99 3.99	4	2	2	510 0 6.73 6.73	
5	N. Y. Susq. & W'n.	0	6	6	6	1,039	0 6.73 6.73	5	6	6	954 0 20.96 20.96	
6	Monongahela	1	11	12	1,060	.94	10.38 11.32	6	11	12	953 0 12.59 12.59	
7	Denv. & Salt Lake	0	12	12	953	0	12.59 12.59	7	12	12	1,045 0 15.45 15.45	
8	Det. Tol. & Ironton	0	17	17	1,100	0	15.45 15.45	8	17	17	1,045 0 15.45 15.45	
9	P'gh. & W. Va.	1	8	9	510	1.96	15.69 17.65	9	8	9	462 0 19.48 19.48	
10	Ak. Cant. & Y'gst'n.	0	9	9	462	0	19.48 19.48	10	9	9	574 0 29.62 29.62	
11	Du. Sh. & Atl.	0	20	20	954	0	20.96 20.96	11	20	20	1,039 0 31.86 31.86	
12	Midland Val.	0	17	17	574	0	29.62 29.62	12	17	17	973 1.03 31.86 31.86	
13	Ga. & Fla.	1	30	31	973	1.03	31.86 31.86	13	30	31	1,039 0 31.86 31.86	
14	Clinch'l'd.	0	30	30	916	0	32.75 32.75	14	30	30	1,039 0 32.75 32.75	
15	Bang. & Aroos.	1	64	65	1,835	.54	34.88 35.42	15	64	65	737 0 36.99 36.99	
16	At'a. & West. Pt.	0	28	28	737	0	36.99 36.99	16	28	28	1,045 0 36.99 36.99	
17	Leh'h. & N. Eng.	0	21	21	557	0	37.70 37.70	17	21	21	1,045 0 37.70 37.70	
18	Char. & W'n. Car.	1	39	40	934	1.07	41.76 42.83	18	39	40	1,045 0 41.76 42.83	
19	Mo. & M. Ark.	1	31	32	716	1.40	43.30 44.70	19	31	32	1,045 0 43.30 44.70	
20	Tenn. Cent.	0	42	42	788	0	53.30 53.30	20	42	42	1,045 0 53.30 53.30	
21	Burl. R'k. Is.	0	79	79	1,273	0	62.06 62.06	21	79	79	1,045 0 62.06 62.06	

*Sum of "Killed" and "Injured."



Between Quebec and Montreal on the Canadian National

WHAT'S THE ANSWER?



Have you a question you would like to have someone answer? Have you an answer to any of the questions listed here?

Encasing Structural Steel

Should structural members, such as girders or floor beams and stringers, that are to be encased in concrete, be given a shop coat of paint? If not how can they be protected from corrosion while awaiting encasement? If so, should the paint be removed prior to encasement? How can this be done

A Small Amount of Rust Is no Detriment

By JONATHAN JONES

Chief Engineer, McClintic-Marshall Corporation, Bethlehem, Pa.

If the steel member is to be erected and encased within a reasonable interval after fabrication, the small amount of rust that will form should be no detriment, but should be of some advantage, because it will show up any remaining mill scale and facilitate its removal, while it will also slightly roughen the surface. We see no reason why the bond between the concrete and the steel in such a condition should be less than that in any rod-reinforced beam, where the steel is practically never painted, and is frequently quite rusted, yet bond is essential to the integrity of the structure.

If a long interval is to elapse before encasement, particularly where the exposure is of such a nature as to promote rust, the steel may be either oiled or painted. It seems obvious in this case, however, that the bond will not be as good if this oil or paint is left in place as if it is removed.

We suspect that in such instances a more practical measure would be to increase the thickness of the steel by a fraction of an inch and leave it unpainted. The loss by rusting would not approach in volume this additional steel, hence the structure would actually be strengthened. We doubt that this would cost more than any worth-while process of painting and then removing the paint. As an example, a B20 beam weighing 55 lb. per ft. could be increased from a web thickness of 0.270 in. to 0.395 in. by the addition of 5 lb. per ft. This additional metal would cost little, if any, more than a good job of painting and the removal of the paint. In any case in which bond is not regarded as important, the paint need not be removed, however, and shop painting would be cheaper than the additional steel.

To Be Answered in February

1. What effect, if any, does the failure to space crossties uniformly have on track? Should the ties be spaced? If so, when should this be done? Should the track be worked merely to space the ties?

2. When driving pile trestles, how accurately can the bents be made to conform to the standard panel spacing where the structure has been renewed several times? What difficulties must be met and overcome?

3. What methods should be employed and what precautions are necessary in shimming on high-speed tracks to insure that the track will remain in condition for the maintenance of normal speeds?

4. What are the relative advantages and disadvantages of using a common pipe as the inlet and outlet for a service tank?

5. What practical methods can be used to remove snow and ice that interfere with the laying of rail in the winter?

6. What are the relative advantages and disadvantages of the various types of doors for freight-house service?

7. Where locomotive cinders are used for ballasting main tracks, what depth is most economical? How wide a ballast shoulder should be provided?

8. What provision, if any, can be made to facilitate the inspection and repair of the end trucks of turntables?

We believe, however, that there are relatively few cases where, if the steel is properly cleaned just before it is encased, there is any detriment to the structure or any tangible loss of steel. We all know that a very little steel makes what looks like a great deal of rust. We believe, therefore, that shop painting is seldom economically justified. If we are wrong in this contention, then there is something radically wrong with rod-reinforced concrete practice in general.

Rust Loosens Mill Scale

By F. E. BATES

Bridge Engineer, Missouri Pacific, St. Louis, Mo.

With the proper scheduling of deliveries, there are few cases where the structural steel need be stored for an appreciable time before it is placed in the forms and encased, so that, in general, no protection of the steel surfaces is considered necessary. The storing of structural steel without protection for a limited period is an advantage, because it serves to loosen the mill scale which is objectionable where beams are to be embedded in the concrete. The light coating of rust which forms on structural steel when exposed to the weather for a

short time, does not reduce the section of the members and its removal is comparatively simple, a light brushing usually being all that is necessary. Where proper scheduling of deliveries cannot be arranged, and it is known that the steel members must be stored in the open for several months before they can be encased, a coat of linseed oil will provide all of the protection that is necessary.

Concrete Is as Effective as Paint

By O. F. DALSTROM

Engineer of Bridges, Chicago & North Western, Chicago

Concrete encasement of structural steel, when used as a protective coating, is applied only where conditions are such that paint will not give the desired protection. The painting of steel that is to be encased is done with one or both of two definite objects in view: (1) To give the steel a permanent protection that can be obtained only with paint; (2) to protect it temporarily until it can be encased with concrete in the permanent structure.

Where paint is used as a permanent protection, the concrete encasement serves only as a secondary protection, to guard the paint against abrasion, mechanical wear or fire. There may be conditions where both materials are necessary for adequate protection, but they are not common among railway structures. When fully reinforced and properly applied, concrete encasement will give better protection than can be obtained by a combination of paint and encasement. The paint of this combination forms a continuous film between the steel and concrete, thus eliminating the possibility of a bond between the two. No engineer would permit the use of painted reinforcing bars in concrete. Where the concrete is placed in contact with the unpainted surface, the adhesion of the concrete to the steel during the process of hardening established a bond making the concrete fully as effective a protection as the paint.

To secure the desired results from the encasement of unpainted steel, certain requirements must be met in the design and application: (1) the encased members should not be subject to excessive flexure or vibration, either of which may cause the encasement to crack; (2) the encasement should be reinforced throughout to prevent local cracks; (3) it should be anchored to the steel member in such a manner that the support of the encasement will not depend wholly on the strength of the bond; (4) it should be thick enough to give it a substantial body and permit the placing of the reinforcement well below the exterior surface of the concrete.

A light film of rust on the surface of the steel will not affect the bond or the effectiveness of the protection. Steel may be exposed to the weather for two or three months, or longer, before the surface needs cleaning for encasement. It will become discolored, but the rust film will be light and will be absorbed by the concrete. We have examples proving that this is true in nearly all reinforced concrete. Where the reinforcing bars are exposed until completely discolored by a thin coat of rust, they are placed in the concrete with no attempt to clean them. When there is occasion to break up such reinforced concrete, no rust is found. It has been absorbed by the concrete and a good bond has been established. When the concrete is broken away, the bars come out clean, with surfaces looking like newly-rolled steel.

If the steel has been exposed longer than expected, the rust should be removed with scrapers and steel brushes. If the surface is then wiped with a cloth soaked in gasoline, the rust color will disappear, but this is an unnecessary refinement. If the exposure has been long enough to permit the formation of scale, the sand blast is the most effective method of cleaning.

If it is known in advance that the encasement will be delayed, the metal can be sprayed with oil, which can be removed just prior to encasement by means of gasoline.

Inspection of old, unpainted bridges that have been encased indicates conclusively that the concrete forms such a complete and lasting bond as to give a practically permanent protection. Bridge floors taken out after 25 years have been found to have perfect surface conditions and to be fully bonded to the concrete. Encasement applied to the bare metal gives full protection. The steel can be kept or put in shape to receive encasement at little or no cost. There are no practical advantages in painting steel that is to be encased, while if this is done, much of the effectiveness of the encasement is lost.

Opinions on This Subject Differ

By C. C. WESTFALL

Engineer of Bridges, Illinois Central, Chicago

There still seems to be some difference of opinion on this subject. For many years, I accepted the opinion that was generally held that such steel should remain free from paint, and eliminated shop painting. In many instances we found it impracticable to encase the steel promptly after it was received, with the result that considerable cleaning was necessary. I am not convinced that this cleaning was always done thoroughly.

After several unsatisfactory experiences, it was decided that even if there were some objection to the shop coat it would be the lesser of two evils, since scale rust is very detrimental in the encasement of steel with concrete. Accordingly we began to require a shop coat on all steel that was to be encased, and are still continuing the practice. Since then, several cases have arisen which have confirmed our judgment in the matter.

In one case, a short through plate girder span was removed after eight years of service. To do so it was necessary to strip much of the concrete from the steel in order to cut the connections. The concrete was found to be adhering to the painted surfaces fully as well as could have been expected had the surface been clean metal, and the red lead film beneath it was unimpaired. In another case, it became necessary to remove the encasement from the lower portion of the columns to jack up a structure that was to be raised several feet. This bridge had also been encased about eight years. The red-lead shop coat was in first class condition and was apparently unaffected by the concrete.

If, as I believe, a shop coat of red lead is not detrimental, I am sure that from other standpoints, it has its merits. In some of our oldest subways, cracks have developed on the under side of the I-beam encasement, parallel to the flanges of the beams. This indicates that the vibrations set up by traffic have loosened the concrete from the steel surfaces. In one case, as a result of inadequate waterproofing, water seeped through the slab, showing a great deal of rust on the under surface. Had this steel been painted, it would have had additional protection against the action of this seepage water.

I am unable to suggest any practicable form of protection for unpainted surfaces while the member is awaiting encasement, other than the use of a heavy oil which would have to be burned off. This practice is followed on a small scale with dowels and exposed reinforcement which extend through construction joints.

The removal of a shop coat of paint prior to encasement presents practical difficulties. My own experience indicates that it is slow and expensive and cannot be done in a satisfactory manner with the equipment usually available on the job. It is clear that a coat of red lead

on encased steel is not objectionable, but on the contrary it is desirable. It protects the metal prior to encasement, while after encasement, if water reaches the member, the paint will afford protection against corrosion. The instances cited showed conclusively that the paint film did not reduce the efficiency of this type of construction.

Concrete Provides Effective Protection

By ALBERT REICHMANN

Assistant Chief Engineer, American Bridge Company, Chicago

In my opinion, structural steel that is to be embedded in concrete should not be painted. This view is based on two reasons: First, that the cement adheres more firmly to the bare steel than to a film of paint; second, if the concrete is well mixed and of sufficient thickness, it is an excellent preservative of the steel which it encases.

In his book on Corrosion, Causes and Prevention, First Edition, 1926, pp. 303 and 304, Frank N. Speller makes these statements:

Concrete, where it can be used, is generally a most effective and permanent protection against corrosion in the atmosphere. Enough cement must be used to fill the voids in the mixture.

Under most atmospheric conditions, however, two to four inches of well-mixed concrete is sufficient to give permanent protection. When not exposed directly to the weather, as in the protection of structural members in buildings, a covering two inches thick will suffice.

Steel that is to be encased in concrete within three months after fabrication does not require any protective coating. For a longer period, it is advisable to apply a coat of linseed oil after fabrication as a temporary protection. It is not necessary to remove the oil film in the field, since it has a thin consistency with practically no body. My opinion, as outlined, agrees with the generally established practice.

Winter Fence Work

To what extent can section gangs repair or rebuild fences during the winter? Where this is done, what advance preparation, if any, is necessary?

Can Be Done Economically

By E. H. PIPER

Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

Repairing fences is a feature of maintenance work that amounts to a considerable sum annually in the aggregate cost of labor and material. Repairs can be made with economy during the winter if there is careful planning by the supervisory officers during the fall just before the forces go on a winter basis.

It has been our practice in this territory to do a large amount of winter repair work. Fences must be maintained to prevent stock claims, and in a stock-raising country these claims are surprisingly large. The repairs consist of setting additional posts, replacing those that have decayed or have been broken, restretching old wire, stringing new wire, applying fence stays and generally strengthening existing fences.

It is our experience that steel posts that can be driven are the most economical. We use a spud bar to get the first 12 in. of depth and the driving requires but a few minutes to a post, if a light driver is fitted over it. We

program our work, and on one subdivision of 110 miles, the program for a number of years has provided that the section foreman and one man will rebuild two miles of fence every year. By doing this consistently year after year the fence on this part of the line is always in good condition.

Deferred maintenance of fences results in added cost when the work is eventually undertaken. By doing the necessary work year after year the costs are reduced to a minimum and in my opinion this constitutes the most economical method, as the work can be done in winter at a time when it does not interfere with important track work.

During the summer months the track forces should devote their time to productive labor on the track, doing work which is not practicable during the winter and which would entail excessive expense if done at that season. Fences can be repaired with substantially the same facility in the winter as in the summer and in my judgment the work should be done at that season.

Winter Repairs Obviate Special Gangs

By J. B. MARTIN

General Inspector of Track, New York Central, Cleveland, Ohio

After many years of experience some roads find it economical to rebuild or repair their fences during the winter months. In my opinion this should be true on the greater part of the mileage of the country. There may be some sections in which the climate is too severe to permit of its being done, but generally this is not so. In most instances fences are built where the ground is well sodded, so that the frost does not quickly penetrate to a depth that will interfere seriously with the driving of posts or the digging of post holes.

If the fence work is done during the summer months it is almost always necessary to provide a special organization for this purpose. If this is not done and the section forces are required to make the repairs, it will be necessary to do this at a time when they are most needed on the track. It is always necessary to maintain some sort of a winter section force to handle essential operating and maintenance jobs, and by careful planning it is seldom that this force cannot also be used for other important work such as fencing. With the type of fence construction now in common use, a normal program of repairs can be completed before the spring track work begins, provided the necessary fence material is available about December 1.

Good Fencing Prevents Encroachments

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

In ample time to order the necessary material, a foreman should check all of the fencing on his section to determine what work is necessary. This should be done by close inspection, since a post that may look good from a motor car may be entirely unfit for further service. He should be alert at all times to prevent encroachments, but at this time he should make a special investigation to insure that the property is properly protected in this respect.

In my experience, I have found that there is little difficulty in making all necessary fence repairs in the winter. Doing the work in this season has the advantage that it does not interfere with other basic maintenance operations. I do not believe, however, that the regular section forces should be expected to build or rebuild any great amount of fence, since this can be done more

economically by a gang specially equipped to build fence.

No special preparation is necessary for the usual run of normal repairs, except to make certain that the required material is on hand in ample time to start the work as soon as the forces go on a winter basis. Where wood, concrete or other posts are to be used which require the digging of post holes, these posts should be set early enough to insure that this part of the work is completed before the frost penetrates sufficiently to stop the digging. Posts that are to be driven can be set for some time after the digging of post holes is impracticable.

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Driving Piles in Winter

To what extent and under what conditions can pile driving be done in the winter? In what respects, if any, do the methods differ from those employed at other seasons?

Winter Retards This Type of Work

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

It is obvious that, in general, piles cannot be driven in the winter with the same facility as at other seasons. The extent to which they can be driven at this season depends largely on the locality and the climatic conditions.

If they are to be driven in standing water, it may be somewhat difficult to place them in the proper line and at the proper points because of the depth of the water or the thickness of the ice. In the wet, cold weather which is an accompaniment of winter in many sections, there is great danger of personal injury to employees who are working on bridges and around the driver. In addition to these hazards, more or less difficulty is often experienced with the freezing of the steam hose around the hammer and of the steam and water lines on the driver, which will, of course, cause delays and loss of productive time.

The driving of the piles at other seasons favors safe working conditions, a greater output from the individual employees, a better quality of work and less likelihood of delay to traffic, all of which are important considerations. In some of our southern states there is no winter season, as such, so far as the driving of piles is concerned. In this territory, particularly in regard to pile driving, we divide the year into wet and dry seasons, and wherever practicable, we endeavor to do our driving in the dry season and during the period of lightest traffic.

They Can Be Driven Successfully

By G. A. HAGGANDER

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

Practically all our pile driving is done with steam hammers and unless the circumstances warrant our doing so, we do not drive piles for maintenance purposes in extremely cold weather. Pile drivers can be operated successfully in the winter time on such construction work as must be handled during that season. For instance, there is usually considerable pile driving in connection with falsework for steel bridge erection and falsework for concrete bridge piers, etc., which are often constructed during the winter.

We sometimes have a construction program that must

be completed early in the year, which makes it necessary to carry on the work during the winter. Under these circumstances we have driven a large number of concrete as well as timber piling during cold weather.

Occasionally our maintenance pile-driving program is so heavy that we have started pile driving as early as January 1, to insure that the entire program would be completed with the equipment that was available.

I do not recommend winter driving of piles, however, where this work can be done as conveniently at other seasons of the year. The cost is somewhat greater because it is necessary to exercise constant precautions to insure that the steam and water lines will not freeze. It is also difficult to use a water jet at this season and this is often necessary. It is possible, however, to overcome these difficulties, but at extra cost.

It is obvious that the territory in which work of this character is to be done has a considerable bearing on the whole question. On our own road, certain of our southern lines are in sections which do not have severely cold winters. On these lines the pile driving can be handled with almost equal facility at any time of the year. In general, however, we do not begin our pile-driving work in the winter, even on these lines, except in connection with projects which can be handled more economically during that season.

Winter Is no Obstacle on This Road

By A. B. SCOWDEN

General Bridge Inspector, Baltimore & Ohio, Cincinnati, Ohio

In the latitude in which the Baltimore & Ohio is located, winter conditions do not present a serious obstacle to the driving of piles, for either trestles or foundations, and they add comparatively little to the cost of the work. The temperatures are seldom so low as to affect the steam operation of either the driver itself or the hammer, although there is an added expense because of the necessity of draining the boiler and pipe lines when the equipment is not in service, or of employing a watchman to keep the fire going during the night.

Frost in the ground varies from 6 in. to 18 in. in depth. The frozen ground is broken up with hand tools and removed to provide holes for entering the piles. Unless the ground is frozen deeper, the expense of doing this is small, and in this climate we seldom find it necessary to resort to any method of thawing the ground. Snow, if of considerable depth, would be a detriment, but in this locality the snow is seldom deep enough and does not remain for a sufficient time to deserve serious consideration. Icy track and roadbed are conducive to accidents, but this applies to all forms of winter maintenance work.

High water, which would retard the work and increase its cost, may occur during the winter season. On the other hand, winter floods in our territory are seldom as frequent or as severe as those which occur during the spring and early summer.

Labor output during the winter period is somewhat less than for equal periods during other seasons. The working day may also be somewhat shorter because of the diminished number of hours of daylight. This is not a serious matter, however, since a full working day can be obtained in reasonably clear weather, even in December and January.

Although it is preferable to drive piles during the warmer seasons because of the somewhat lower cost, there is an advantage in keeping the equipment busy and the forces intact. For these reasons, we never hesitate to

do our pile driving during the winter, provided our program is such as to make this desirable. In more northern latitudes or at higher altitudes the problem may be different.

Shop Drains

What methods, if any, can be employed to prevent the heavy sediment from battery-repair shops from entering the shop drains?

Sumps Remove Sediment

By R. L. HOLMES

Engineer Water Supply, Texas & Pacific, Dallas, Tex.

The most satisfactory method of causing a separation of any form of sediment is to reduce the velocity of discharge. This may be accomplished in this instance by introducing a sump into the drainage system between the battery-repair shop and the main lines of drainage. The velocity of discharge approaching the sump should be not less than 6 ft. a sec., and this should be reduced to a maximum of $\frac{1}{2}$ ft. a sec. through the sump.

The overall length of the sump should be 20 diameters of the inlet pipe or drain, and a sharp-edged weir should be placed across the sump at the middle point so that it will be perpendicular to the direction of flow. The top of the weir should be level with the bottom of the inlet pipe. The depth of the sump should be sufficient to accommodate an accumulation of two or three days' deposit without approaching too near to the elevation of the bottom of the inlet pipe. The width of the sump will depend entirely on the volume of discharge. It is safe, however, to assume a maximum of 20 gal. per min. to each foot of the width of the weir.

The location of the sump should be at some point which is convenient for the removal of the sludge. The removal can be accomplished by means of a pump or scoop depending on the character of the sludge which is deposited.

Sediment Should Be Wasted

By C. R. KNOWLES

Superintendent Water Service, Illinois Central, Chicago

Secondary or storage batteries are divided into two general classes—lead batteries and caustic or alkaline batteries. Lead batteries consist essentially of two lead electrodes which are immersed in an electrolyte or dilute sulphuric acid. The alkaline type has as its active materials grids composed of oxides of nickel and iron respectively, while the electrolyte is a solution of caustic potash in water.

When making repairs to or renewing the elements in lead batteries, it is common practice to save the sulphuric acid, provided it is not too badly contaminated, emptying it into a tank for use in other batteries. The sediment from the battery is, or should be, wasted on the ground.

Under no circumstances should the electrolyte from lead batteries be allowed to enter the sewer or drain in its natural state, since it may be destructive to the drain and it may also cause the generation of dangerous gases. It may be neutralized, however, by adding soda ash until it ceases to foam, after which it may be allowed to enter the drain with safety. Regardless of the disposition of the liquid, the sediment should be settled out and wasted on the surface of the ground.

On the other hand, the electrolyte from alkaline batteries may be run into the sewer with safety, since it will cause no damage. The sediment should be deposited on the surface of the ground, however, in the same manner as that from the lead batteries. It is common practice to pour the electrolyte from alkaline batteries around ground rods or plates to increase the conductivity of the earth, thus forming a better ground contact.

Ballast Shoulder

What effect does the width of the ballast shoulder have on track? What determines the proper width? Does it vary with different types of ballast? Why?

Line and Surface Are Affected

By J. R. WATT

General Roadmaster, Louisville & Nashville, Louisville, Ky.

Both line and surface are affected to a considerable degree by the width of the ballast shoulder. The correct ballast shoulder is one which affords sufficient lateral support to the track to hold it in line and distribute the moving loads over as great an area of the subgrade as is possible, yet contains no surplus material. Where the roadbed and traffic conditions tend to cause churning track, the ballast shoulder that is best is just sufficient to provide the required support. Excessively wide shoulders tend to aggravate the tendency toward churning, and in addition represent a waste of ballast.

Determination of the proper width must be made on the basis of the height of the subgrade, the depth of the ballast, the alignment and the traffic conditions. This width will vary to some extent with the type of ballast that is to be used. It is especially true that gravel ballast must have a wider shoulder, since it has a flatter angle of repose than ballast that contains a high percentage of sharp or angular material, and a greater quantity is required, therefore, to hold the track in line. Rock, crushed slag, etc., which contain much sharp, angular material, will stand on a steeper slope, so that a narrower shoulder is not only practicable, but desirable.

Character of Roadbed Is Important

By F. M. THOMSON

District Engineer, Missouri-Kansas-Texas, Parsons, Kan.

Ballast shoulders should be of sufficient width to keep the line and surface stable, with economy in first cost and maintenance. Special consideration should be given to the character of the roadbed, the traffic requirements, the climatic conditions and the nature and type of the ballast that is being used. Each particular territory that is to be ballasted should be made an individual study, and the width of the shoulder, the depth of the ballast and its width at the base should be determined for that stretch of track or district.

Where, owing to soil or other reasons, the roadbed does not support the track firmly, the ballast should have a heavier shoulder, a greater depth and a wider base to aid in stabilizing the track. This applies also to track over which heavy equipment is operated at high speeds and where the traffic is dense. Wet and cold climates often necessitate a reduction in the width and slope of the ballast shoulder to facilitate drainage. This is also true of ballast materials that do not drain as freely as others, and have a tendency to churn. Ballast materials

that are loose and free-draining, such as clean sand and washed chatts obtained from the crushed quartz tailings of zinc and lead mines, require heavy shoulders to keep them bedded between the tie and the roadbed. Other ballast materials which have a high specific gravity, such as crushed stone and slag, do not require so heavy a shoulder.

It is not economical to apply or maintain a ballast shoulder that is wider than actual requirements demand. Not only are the costs of original application and replacement higher, but the unit cost of labor for working the track is higher for such operations as applying ties, spot surfacing, lining, etc., owing to the greater amount of ballast which must be handled. Too frequently, a typical and theoretical ballast section is adopted as a standard and followed religiously on different sections of the road, instead of adjusting the section to meet the varying character of ballast that is used and the other conditions that are encountered.

Depends on Type of Ballast Used

By L. J. DRUMELLER

Division Engineer, Chesapeake & Ohio, Hinton, W. Va.

Ballast placed in the form of a shoulder outside the ends of the ties, acts definitely to keep the track in proper line and surface. The absence of a shoulder would, in my opinion, lead ultimately to center-bound track, since it would open up the way for the ballast in the cribs and under the ties to work out and down to the shoulder of the subgrade. It is essential, of course, to maintain the ballast in the shoulder in a thoroughly clean condition at all times; otherwise sloppy, churning track will result. Furthermore, the function of the ballast shoulder is also to provide lateral support to assist in keeping the track in line.

The proper width depends on the depth and kind of ballast in use, on the standard of maintenance and on the ballast section which has been adopted by a particular road. It is desirable from every point of view to maintain a shoulder as narrow as practicable, and yet provide a slope on which the various ballast materials will stand. Since crushed stone will remain stable on a steeper slope than gravel, it follows that gravel shoulders should be wider than those for stone, the same depth of ballast being assumed for both.

Another item that should not be overlooked is that of appearance. Nothing in connection with track is more pleasing to the eye than a well-maintained and uniform ballast shoulder. This is an asset that no railroad can afford to ignore.

Shoulders Keep the Tamping Tight

By W. F. MONAHAN

General Track Inspector, Southern Pacific, San Francisco, Cal.

Ballasted track which has from 10 to 12 in. of ballast under the tie should have a shoulder that is 10 to 12 in. wide. The shoulder should be practically flat on top and approximately three inches below the upper face of the ties at its end. From this point the slope should reach the plane of the upper face of the tie at a point 10 in. inside of the rail. This standard should be used with all types of ballast, provided the material is of a permeable character.

Where the ballast is dressed in this manner, the tie is given a snug bed, and there is sufficient body in the shoulder to hold the tamping tight and in place under the ends of the ties. The reasons why it is advantageous to keep the ballast three inches below the tops of the ties

at their ends and an open space in the crib under the rail are many. It reduces the cost of removing the ballast from the crib when necessary to tamp the ties; it does not interfere with the application or removal of anti-creepers; it does not interfere with adzing when this becomes necessary; it prevents fine particles of grit or dirt from remaining on top of the ties or churning and cutting around the seat of the tie plate, thus minimizing the wear and damage to the tie; it avoids the probability that small particles will work into the checks on the tops of the ties, thus aggravating their condition.

Three inches is about the limit that it is safe to go below the top of the tie, however, since a greater depth reduces the body of the ballast in the shoulder and permits it to loosen at the ends of the ties sufficiently to start a center bound condition.



Distributing Small Rail Fastenings

When laying rail in winter, how should the spikes, bolts, nut locks, etc., be distributed to avoid loss of material?



Distribute Behind the Rail-Laying Crane

By T. E. QUINN

Assistant Engineer, Wabash, Decatur, Ill.

"Laying rail in winter" has a wide range of significance owing to the variation in climate as one travels from south to north. In the extreme northern sections of the United States and in Canada, the country is subject to intermittent falls of snow, so that the accumulations may be of considerable depth. It is obvious, therefore, that methods that are satisfactory when the ground is clear of snow cannot always be used when other conditions prevail.

In the winter, track fastenings should not be distributed much in advance of the rail laying, since they may be covered with snow or freeze to the ballast. In some cases it is practicable to distribute about one day's supply of these fastenings in packages in advance of the rail gang. However, in severe climates or where the weather is at all unsettled even this is not a safe practice, and the better method is to unload the packages immediately ahead of the rail-laying operation and then distribute the individual items at the point of use immediately behind the rail crane.

This Is an Important Question

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

Owing to the considerable investment that is involved in rail fastenings and the ease with which they can be hidden by even a light covering of snow, the proper method of distribution for winter work becomes a matter of major importance. For these reasons, every effort should be made to place such material as spikes, bolts, spring washers, tie plates, tie plugs, anti-creepers, etc. so that the probability of its becoming lost under the snow or tramped into a soft embankment will be reduced to a minimum.

Materials of the types mentioned should be placed carefully outside of the new rail and distributed only a sufficient distance in advance of the gang to insure that there will be no shortage of material for the current day's needs. This distribution can best be made from a push car that is run ahead of the rail gang.

For winter work, the new rail should be unloaded and placed near the ends of the ties, and the angle bars should be coupled to the rail with one bolt. The remainder of the fastenings should be placed outside of the new rail to avoid interference when the rail is picked up for insertion in the track. As the old rail is thrown out, it should be worked across to the opposite side of the track. If this practice is followed, it is less likely that the small items of material will be trampled over and covered with snow or buried in the ground of a soft embankment. The same method of placing these materials is equally adapted for other seasons of the year, and is recommended as standard practice, although the preliminary distribution can safely be made much farther in advance. It should be the supervisor's duty to see that all employees involved in the rail-laying operation are impressed with the necessity for handling all of the materials they use in such a manner that none of it will be lost either temporarily or permanently.

Depends on Amount of Snowfall

By W. R. GARRETT

Yard Foreman, Chicago, Burlington & Quincy, Pacific Junction, Iowa

Methods of distributing the small rail fastenings for winter work may well be varied to conform to the climatic conditions and the amount of snowfall that may generally be expected to prevail in the particular locality in which the rail is to be laid. If the work is to be done early in the winter in a section where little, if any, snow falls before January 1, I am of the opinion that the fastenings can safely be distributed well in advance of the rail gang. Under these conditions, little, if any, material will be lost. On the other hand, if a heavy fall of snow should occur unexpectedly, which will happen infrequently, the material that is covered up can be salvaged later, since early snows seldom remain on the ground for any length of time. If by any chance the warm period is delayed and no thaw takes place within a reasonable time, the material will remain undisturbed and can be salvaged by the section gang and used for ordinary maintenance.

When rail is laid in territory where the snow fall is likely to be heavy, or when done anywhere later in the winter, the small fastenings should be distributed behind the rail crane. It is practicable for two men to do this part of the work. The best arrangement is to couple a push car to the rail crane and distribute the material from this car. To facilitate this practice, the reserve supply is unloaded at proper intervals along the track to replenish that on the push car as it becomes depleted. Where this method is followed, it is necessary to make the distribution immediately behind the rail crane in order to serve the gage spikers and head bolters.

Distribute for Each Day's Needs

By E. E. CROWLEY

Roadmaster, Delaware & Hudson, Oneonta, N. Y.

It is most important that rail fastenings be distributed in such a manner that no material will be lost or displaced, since much time will be wasted if it is necessary to stop and look for it. In our practice, the fastenings are usually received at the time the rail is delivered. Where this is done, they can be distributed at the same time that the rail is unloaded. On the basis of 39-ft. rails, which are now commonly used, my practice is to distribute the fastenings in the following manner:

Angle bars are unloaded in pairs, each pair being placed across the end of a rail. If they are unloaded at

random, or are left lying on the ground near the rail, they are likely to become covered with snow and lost.

On the basis of 72 bolts to a keg and 4 to a joint, one keg is unloaded every nine rail lengths to provide the required number of bolts in each joint for every panel of track. The kegs should be set upright and at the proper distance from the track for clearance.

Track spikes average about 228 to the keg and 88 are required to a panel, which means the unloading of one keg to every 2½ rail lengths. As with the bolts, the kegs should be placed upright with proper clearance. In both cases, care should be exercised to insure that the kegs will not be broken.

Rail-joint springs come in bundles of 25 each. Four such springs, two to a joint, are required for each track panel, so that one bundle should be unloaded every six rail lengths. In order to insure against loss, they should be placed on the tops of the bolt or spike kegs.

When making the final distribution of the fastenings, they should be unloaded ahead of the gang, using a push car for this purpose. Only enough material for one day's work should be distributed. This will eliminate the probability that they will be covered with snow, making it impracticable to reclaim them until the snow has disappeared. If other materials, such as tie plates, anti-creepers, etc., are to be used, the same method of distribution should be employed.

Floors of Tool Houses

Should the floor of a section tool house be set above or below the top of rail of the adjacent main track? Why?

Should Be Set Below the Rail

By FRANK R. JUDD

Engineer of Buildings, Illinois Central, Chicago

Safety is one of the prime considerations in the erection of a building or other facility, and section tool houses are not exempt from this consideration. For this reason, the floors of such buildings should always be placed below the elevation of the top of the rail of the adjacent track which is used as an approach to the tool house. In my opinion the floor should be on a level with the base of the rail on this track.

Where this is done, the runway leading from the track to the house is pitched away from the track, thus avoiding the possibility that a section car, of whatever type, which may be standing on the runway, will move toward the main track and foul a passing train.

Runway Should Drop Away from Track

By L. L. ADAMS

Division Engineer, Louisville & Nashville, Evansville, Ind.

Experience has shown that the floor of a section tool house should be set slightly below the top of rail of the adjacent track. If this is done, cars placed on the runway leading to the tool house will not have a tendency to roll toward the main track and foul a passing train, in case they are not properly secured against movement.

The drop away from the track need not be very great; only enough to prevent the cars from rolling toward the main track. If the grade is too steep, there is danger that the car may roll toward the tool house and catch someone between the car and the building after the doors are closed, causing personal injury. As a corollary, all

motor-car setoffs along the line should also be constructed with a slightly-descending grade away from the main track.

There is Only One Safe Method

By A. L. SPARKS

Architect, Missouri-Kansas-Texas, St. Louis, Mo.

It is doubtful whether any conditions or circumstances could ever justify placing above the track level, the floor of a section tool house or other roadway building, in which track motor cars or other rolling equipment are stored. If the short runways used to facilitate the handling of the cars are pitched toward the track, a car standing outside the house may start moving and be demolished by a passing train or cause a serious wreck. If conditions are such that it is impracticable to set the floor of the house below the top of rail, it would be advisable to install wheel stops on the runway to avoid the possibility of the car slipping down and fouling the main track.

Supply Lines to Water Columns

Should the supply line be of the same or of larger size than the water column which it serves? Where two or more water columns are connected to the same supply line, of what size should it be?

Rule of Thumb Method Is Poor Practice

By R. C. BARDWELL

Superintendent Water Supply, Chesapeake & Ohio, Richmond, Va.

This question is an example of the lack of understanding of many railway officers of the technical consideration involved in the handling of railway water-supply problems. The rule of thumb method of controlling the size of water-column supply lines by the size and number of columns is no more in line with good economic practice than would be a similar method applied to bridge design or the track structure.

To begin with, the size of the water column itself should be governed by the general average requirements and conditions on the individual road, always from the viewpoint of standardization and simplification. There is little difference in cost between the different sizes of water columns. It is usually considered good practice to select one type and size, usually one having a 10-in. or a 12-in. vertical column, and standardize on that. The question of the availability of repair parts is of prime importance in selecting a type of water column for standardization, particularly since the rate of delivery, as between present models of the various manufacturers, is fairly comparable.

Detailed discussions of the deliveries that may be expected from various designs of water columns under a considerable range of conditions will be found in Bulletin No. 48, University of Illinois Engineering Experiment Station; and in the report of the Water Service committee of the A.R.E.A., pp. 1182-1217, Proceedings for 1910. This work has been supplemented by further studies which were made by the Hydraulic Engineering department of the University of Wisconsin, all of which information is available to those who are interested.

After the size and type of the column have been selected, the size of the supply line and the delivery head will control the rate of delivery to the locomotives. It

is usually considered desirable to make this rate the maximum which can be handled safely, which now appears to average between 3,500 and 4,000 gal. a minute, to avoid unnecessary delay to trains. To secure this rate of delivery, the height of the service tank or the size of the supply line must be adjusted to care for the friction loss.

Usually the height of the tank is fixed by local conditions, so that the size of the pipe line becomes the variable factor. This can be determined by calculation or by reference to the charts contained in the A.R.E.A. Proceedings for 1929, pp. 195-200, inclusive. This information was furnished for one type of water column, but is adapted for general application. If desired, however, a similar chart can be obtained from any reputable manufacturer of this equipment, for application to his own product.

Consideration should always be given to probable future increases in demand, as well as to a possible decrease in the capacity of the line as a result of sedimentation or incrustation. These observations will apply whether the supply line is intended to serve one or more columns. Satisfactory results can be assured only when the demands and requirements are fully checked in line with available information, instead of relying on an arbitrary size, as compared with the water column under consideration.

Depends on Frequency of Use

By C. H. KOYL

Engineer Water Service, Chicago, Milwaukee, St. Paul & Pacific, Chicago

On the road with which I am connected, we have 326 water columns, which are practically all of the 10-in. size. With few exceptions, these columns are supplied through 10-in. cast-iron pipe lines from nearby service tanks of such height that they enable the columns to discharge their rated capacity. Our road serves a large territory in the more open country, and has many water stations, about 300 in number, where water is taken directly from the tanks through tank spouts. At the larger stations, the platform work generally takes more time than is needed to water the locomotives by means of water columns, so that there has been no necessity for increasing the speed of delivery.

In a few instances, 12-in. supply lines are used to feed into two 10-in. branches. This is done, however, more because of the distance from the tank to the columns than to supply adequately two columns at one time. Where two locomotives must take water simultaneously from connected 10-in. columns, the supply line should be 14 in. in diameter, but this condition rarely occurs with us.

It seems to me that the use of a pipe larger than the flow area of the water column, to supply two columns, depends on the frequency with which the two columns are used at the same time. If this occurs frequently, the supply main should be of sufficient diameter to serve both columns, and this is a matter of simple calculation. On the other hand, if the simultaneous use of the columns is infrequent, then the regular pipe will be sufficient.

A NATIONAL RAIL SYSTEM—The formation of a single corporation comprising the entire railway system of this country was advocated by Nathan L. Amster, president of the Citizen's National Railroad League, Inc., in a statement issued on November 4. The corporation would be managed by a board of governors representing security holders, shippers, labor and the public.

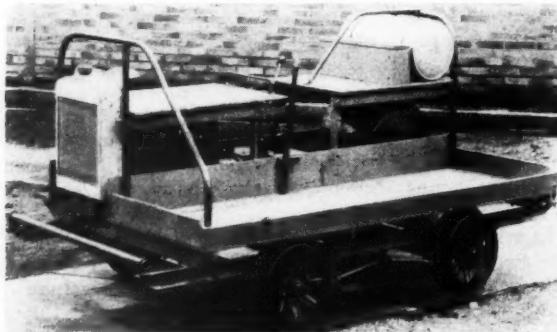


NEW AND IMPROVED DEVICES

A Four-Cylinder Paint Spray Car

RECONIZING the need for a motor car equipped particularly for paint spray service, Fairmont Rail-way Motors, Inc., Fairmont, Minn., has developed a car that is fitted with an air compressor for use in paint spraying operations. The new car, which is known as the A36 paint spray car, is powered with a four-cylinder, ball-bearing engine which has a two-cylinder, heavy-duty, water-cooled air compressor operating on the same crankshaft. Simplicity and compactness are obtained by combining the engine and compressor into a six-cylinder unit.

The piston displacement of the compressor is 36 cu. ft. of free air per minute, which is said to be ample for the operation of two paint spray guns in continuous heavy service, or for the operation of four guns in intermittent service. When the car reaches the scene of the work, the compressor is started by setting the gear shift in neutral and closing the compressor relief valve. When



Fairmont A36 Paint Spray Car

it is again desired to operate the equipment as a motor car, the compressor relief valve is opened.

The A36 has a four-speed, two-way transmission which enables it to haul several trailers loaded with ladders, scaffolding and paint supplies at a good speed in a territory of sharp curves or steep grades. A deck tray, 32½ in. wide and 95 in. long, is provided for carrying large quantities of material without resorting to the use of trailers. Ladders can project at either end.

Other features of the car include a propeller-shaft drive and an all-enclosed gear, comprising a ball and roller bearing transmission and reverse gear, which reduce upkeep to a minimum and provide quick reversibility and four speeds in either direction. The latter have been found advantageous in keeping out of the way of traffic around station yards.

Excessive car or compressor speeds are prevented by a ball-bearing governor which is enclosed and runs in

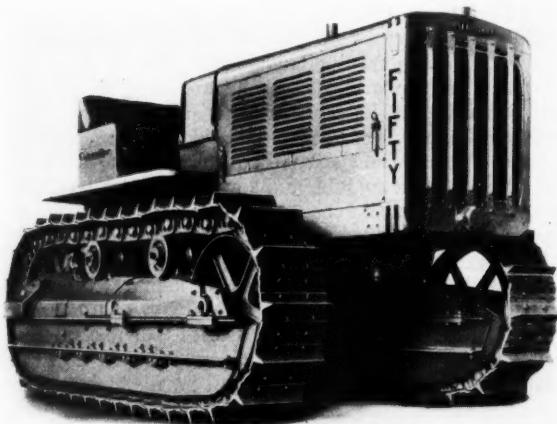
oil. Lower car speeds are secured by a hand throttle. Owing to the fact that the car is equipped with a ball-bearing fan and a radiator that is large in proportion to the horsepower, it is said that very little water is required.

The handling of the car is facilitated by rail skids, a bronze-bushed loose wheel and a long frame. It is readily set off the track and rolled near the building to be painted. A quiet muffler is provided to prevent the disturbing of the occupants of the buildings. This car is equipped to supply air for any make of spray gun.

Caterpillar Brings Out New Model

THE Caterpillar Tractor Company, Peoria, Ill., has added a new model to its line of tractors, known as the Fifty, which, in size and capacity, falls between this company's Thirty and Sixty tractors. In general the new model is designed along the lines of the smaller models of the Caterpillar line. It has four speeds forward and one in reverse, which, in miles per hour, are as follows: First, 1.6; second, 2.4; third, 3.4; fourth, 4.7; and reverse, 1.9.

The engine is of the four-cylinder, four-cycle, water-cooled, valve-in-head type, with a bore of 5½ in., a stroke of 6½ in. and a governed speed of 850 r.p.m. The fuel tank has a capacity of 65 gal. The maximum



The New Caterpillar Fifty Tractor

belt horsepower is 57. The new model has an over-all length of 146½ in., an over-all height of 75¾ in. and an over-all width of 78½ in. From center to center of the tracks the gage is 60 in., the length of the tracks on the ground from the center drive sprocket to the center front idler is 87½ in., and the area of ground contact

with standard track shoes is 2,456 sq. in. The width of the track shoes is 15 in., and the grouser height is 2½ in. In general the same items of special equipment that are available for the Sixty and Thirty are offered for the new model.

A Gas-Electric Locomotive Dump Car

AMATERIAL-HANDLING unit in which a locomotive and a dump car body are mounted together as a self-contained piece of equipment has been perfected by the Differential Steel Car Company, Findlay, Ohio. Briefly, the unit consists of a dump body mounted on a locomotive chassis to which a dumper and trailer dump cars may be attached.

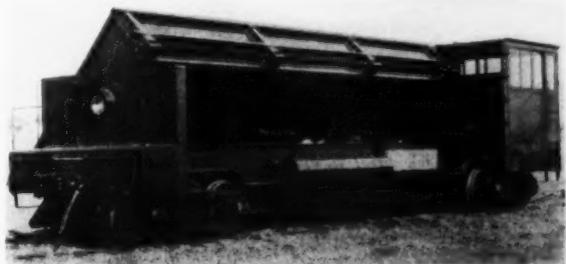
The dump body, which is constructed entirely of heavily-reinforced steel, has a level load capacity of 24 cu. yd. and a normal crown load capacity of nearly 40 cu. yd. During the dumping operation, which is controlled by the operator from the cab at the forward end of the unit, the body moves in a horizontal direction and then tilts to the dumping position. In this operation, the side door is automatically lowered until it lies in the plane of the dump body floor.

The locomotive is of the gas-electric type, being operated by a double power plant which is carried in a sling hung between the center sills. In this position, it is said that the power plant is completely protected from falling material. It consists of two Buda-type JH-6 gasoline engines, each rated at 155 hp. at 1,200 r.p.m., two Westinghouse Type 180-D-5 generators and four Type 908-RH motors, together with the necessary control apparatus. The use of the double power plant is said to add to the flexibility and economy of the unit by reason of the fact that one of the engines only may be used when light loads are being dumped or switched. In addition, it is said that standardization of equipment for both small and large cars may be secured.

The generators are arranged in such a manner as to charge the battery when the engine is idling, and also serve as series starting motors for the engines, using the battery as the source of power. The radiators, which are of the sectional type, are mounted along the side sills, and the air is circulated through holes in these members by means of fans. The unit is fitted with Westinghouse air

generators and propelling motors. This equipment is designed to provide the maximum tractive effort at low speed during the first stages of acceleration, and at the same time to furnish high speeds when a large tractive effort is no longer required.

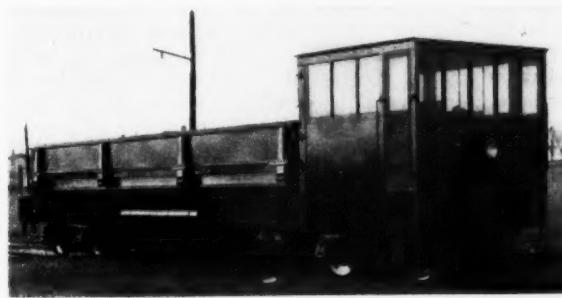
The controller is known as Type XD-50 and is arranged with two handles, one for reversing the direction of motion of the locomotive and for connecting the motors in series or parallel, and the other for controlling the speed of the engine and, therefore, of the locomotive. Starting and stopping of the engines, and the reversing, accelerating, dumping and starting and stopping of the locomotives are done from the operator's station. The equipment is safeguarded against dangerous or



In the Dump Position

abusive handling by means of mechanical interlocking between the handles of the controller; in addition, unauthorized operation of the locomotive is prevented by the use of a key.

It is suggested that one manner in which this equipment is operated to advantage is to use one unit of the power plant to generate electric power for the operation of a dumper for loading the locomotive and a trailer car, while the other unit of the power plant moves the locomotive. For this operation, the equipment consists of the locomotive unit, a trailer dump car and the dumper, with the latter hooked up between the other two units.



The Dump Body Is Constructed Entirely of Reinforced Steel

brake equipment, air being supplied by two Gardner-Denver 60-cu. ft. capacity compressors, one belted from each engine. The distance from center to center of the trucks is 29 ft. and the wheel centers are 5 ft. 6 in. The speed of this unit may be varied, and suitable power plant characteristics for different operating conditions may be secured by varying the size of the gasoline engines,

New Creepcheck Applied by Maul

THE Creepcheck Company, Inc., New York, has developed a new design of Unit anti-creeper, which, unlike its predecessor, is applied by a spike maul. It is not intended that the new design shall take the place of the older one, but rather that it will provide those who desire with the Unit anti-creeper in a form which does not require a special tool for its application.

Fundamentally, the action of the new and older models is the same, in that it secures its binding grip on the rail through three points of contact with the rail base: the under side of the top of the hook, the top side of the under part of the hook, called the hump or fulcrum, and the outer end of the anchor, on the opposite side of the rail base. While there is some longitudinal spring action in the anti-creeper which adds to its grip on the rail, the main holding power is secured through the lever action in the rail base about the point of the anchor called the hump or fulcrum.

The fundamental difference between the new and older models is that in the new model, the curve in the base has been extended toward the hook end in order to afford a readily accessible striking face, whereby the anti-creeper can be given into place by a maul. In order to facilitate the driving of the anti-creeper, certain modifications have been made in the hook, which allow the

cam face of the outer end to come into contact with the rail base when the anti-creeper is hung loosely in place for driving. It is said that one hard blow with a spike maul will set the anti-creeper, or remove it from the



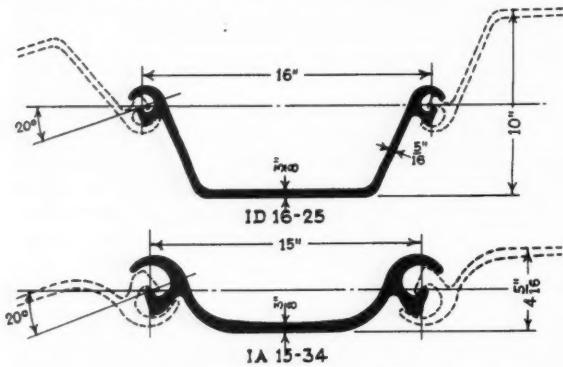
The New Unit Anti-Creeper

rail, and that, owing to its design, it can not be over-driven and its grip on the rail weakened.

The new model, owing to the extension of the base curve under the rail, has a larger bearing area against the tie than the older model, and, like the older model, has two locking notches, one tighter than the other, to permit take-up for wear.

Inland Introduces Sheet Piling

THE Inland Steel Company, Chicago, has added steel sheet piling to its line of products by introducing two new steel sheet piling sections. These two sections which have a strong interlock, are of different types. One of them, known as the 1A 15-34 and of rugged proportions for hard driving or rough handling, is 15 in. wide, center to center of interlocks, weighs 42.5 lb. per foot of section, or 34 lb. per square foot of wall, and has a section modulus of 6.74 per lineal foot of wall. The other sec-



The New Sheet Piling Sections

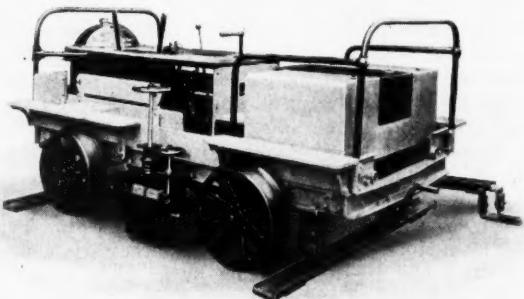
Section	1A 15-34	ID 16-25
Weight per foot	42.50 lb.	33.32 lb.
Weight per Square Foot of Wall	34.00 lb.	25.00 lb.
Moment of Inertia	19.10 in. ⁴	49.60 in. ⁴
Section Modulus per Single Section	8.42 in. ³	13.44 in. ³
Section Modulus per Lineal Foot of Wall	6.74 in. ³	10.08 in. ³
Radius of Gyration	1.23 in.	2.25 in.

tion, the ID 16-25 is lighter but has a greater transverse depth of section and, therefore, offers greater resistance to lateral pressure. It is 16 in. wide, center to center of interlocks, weighs 25 lb. per square foot of wall and has a section modulus of 10.08 per lineal foot of wall. The properties of the two sections are given in the table.

Reciprocating Track Grinder

THE Railway Track-work Company, Philadelphia, Pa., has added to its line of track grinders a motor-car-mounted and operated track grinder of the reciprocating type, designed specifically for steam railway use in the surfacing of joints in new rail installations, the final smoothing up of rails at joints where the ends have been built up by the arc welding process, and in removing corrugations or other inequalities in the tops of the rail heads. The new machine, called Model P-7, which employs the reciprocating or planer method of grinding instead of the rotating grinding wheel method, includes two grinding units, located on opposite sides of the motor car, directly over the rails, between the forward and rear wheels.

The grinding units in each case consist essentially of a cross-head or abrasive block holder, which is free to move back and forth longitudinally over the rail in suitable guides. The cross-heads are designed with a stroke of 3½ in. and operate at a rate of 200 strokes a minute. Both heads are driven by the 40-hp. Ford industrial gasoline engine with which the car is equipped, having con-



The New Model P-7, Motor-Car-Mounted Reciprocating Type Grinder, Showing the Derailing Rollers and Frame Provided

nnection with the main drive shaft of the engine through a roller chain and a crank shaft and connecting rod.

The abrasive used by the machine is in the form of blocks 10 in. long by 4 in. wide, by 3 or 3¼ in. thick, two such blocks being used in each cross-head or holder with a space of ½ in. between them. The blocks are placed end wise in the cross-head, thus pressing their lower ends to the top of the rail, and are held in position securely by means of a wedge along one side of the holder which can be raised or lowered by means of a small hand wheel.

When the machine is in operation, the blocks are held downward against the rail at a uniform pressure by a coil spring interposed between a load-distributing bar across the tops of the blocks and the lower end of a vertical hand wheel shaft. As the blocks wear, the holding wedge is slackened by means of the small hand wheel attached to it, and the lowering range of the blocks under pressure is increased by turning down on the hand feed wheel. For road travel of the car to and from points of grinding, the pressure on the tops of the grinder blocks is released and the blocks are raised and clamped above the lower limits of the holders, which themselves provide clearance of about ⅜ in. above the rails.

With its relatively long and straight grinding face, the new grinder produces a smooth tractive surface on the rail or across the joint, and, inasmuch as the blocks, when first used, quickly assume the normal contour of the rail head, they grind the full top face of the rail head in accordance with the normal shape of the head, and, therefore, do not produce a flat surface on the top

of the head. Service tests of the grinder show that it takes from 5 to 8 minutes to grind an average welded joint after the joint has been first roughed off by a rotating emery wheel grinder, and that it requires from two to three minutes to grind down the average uneven joint in track laid with new rail.

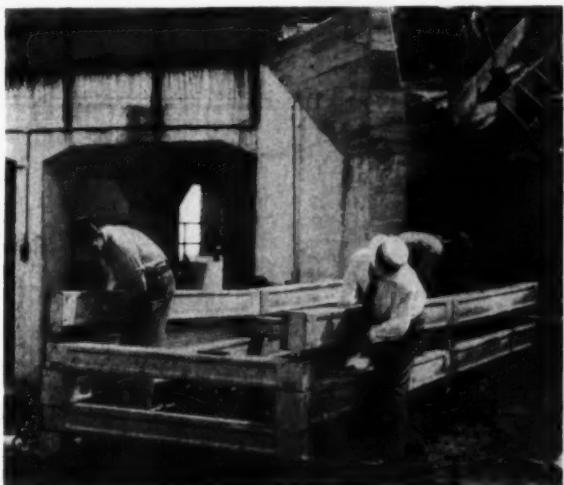
The grinder car is of the heavy-duty type, with wheel insulation to prevent interference with signal systems, and weighs approximately 3,600 lb. For derailing the car to permit the passage of trains, a special steel track frame is supplied, insulated on the bottom side, which is set transverse to the track rails in such position that it will engage rollers which can be lowered at the four corners of the car frame. The derailing rollers are operated by a single hand crank at the rear of the car.

Crib Wall Units Now Made of Armco Iron

THE USE of Armco iron for the construction of crib retaining wall units is the latest development of the Armco Culvert Manufacturers Association, Middletown, Ohio, which is now prepared to furnish stretchers and headers for open-wall construction as well as filler units by means of which closed-wall construction is readily obtained. These units are fabricated in accordance with fully developed plans that provide simple means of assembly. Units for a retaining wall on a railway line near Middletown were recently erected and arrangements for several other railway installations are being made.

The units are formed on dies from standard Armco culvert stock, the headers being six inches square in section and six feet long while the stretchers are eight inches deep, six inches thick and eight feet long. The

stretchers in the course above are secured to the header by means of depending flanges on the end diaphragms in the stretchers, which are pushed through slots provided in the top of the header. When the stretchers are seated on the header, holes in these flanges match with holes in the two sides of the header and in a gusset plate inside the header, after which a long bolt is pushed through from one side and the nut applied

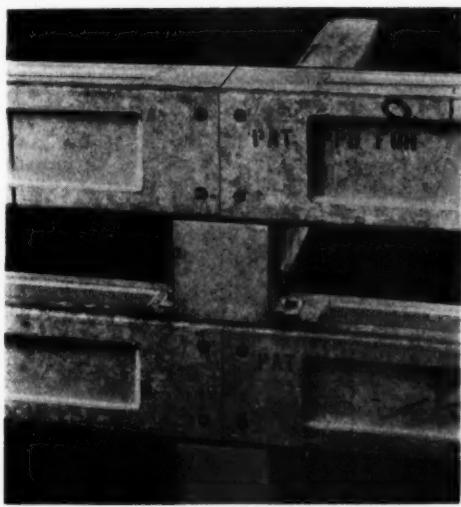


The Crib Wall Units are Readily Assembled

on the other. The fillers furnished where a closed wall is desired are bolted to the top of the stretchers below and interlock into the open bottom of the stretchers above.

The stretcher has a calculated moment of inertia approximately equal to that of a 5-in., 10-lb. I-beam. In a laboratory compression test of a joint assembly of two headers with a pair of stretchers, initial failure occurred under a load of about 60,000 lb.

The primary advantage of this construction is its light weight—an eight-foot stretcher weighs about 70 lb., and a standard header about 60 lb. As a consequence, the walls are erected with a minimum of labor. In other respects, the manufacturers claim the advantages secured in crib walls constructed of wood or concrete and point to records of long service life of the material as used in culverts as ample demonstration of its durability in retaining walls where the service requirements are less severe since the erosion effect to which the metal is exposed in culverts is absent in walls. Another advantage to which attention is directed is the high salvage value to be realized because of the small amount of labor necessary for dismantling in any case where the material supported must be removed.



Close-up View of the Joints

units are closed on the top and sides and open on the bottom to facilitate connection when they are being erected. Suitable diaphragms are riveted into the ends to provide the required compressive strength at the joints, while several intermediate diaphragms are also provided.

The header is connected with the stretchers of the course below through the agency of projecting flanges or lugs on each side, which have bolt holes that match corresponding holes in the top faces of the two stretchers.



St. Louis Southwestern Bridge over the Ouachita River, Camden, Ark.



NEWS OF THE MONTH

R. F. & P. Takes Mail Pay Case to Supreme Court

The Richmond, Fredericksburg & Potomac has petitioned the Supreme Court of the District of Columbia for an injunction to restrain the comptroller general of the United States from withholding money due the railroad for mail and other transportation, to apply on the amount the Interstate Commerce Commission is seeking to collect under the recapture law.

G. N. and W. P. Open New Line

Ceremonies culminating in the driving of a golden spike at Bieber, Cal., celebrated the completion of an extension connecting the Western Pacific and the Great Northern, on November 10. This line comprises an extension of the Great Northern south from Klamath Falls, Ore., to Bieber and an extension of the Western Pacific north from Keddie, also to Bieber, establishing a new through, all-rail route between the Pacific northwest and California, and also providing a new route from eastern points to California by way of the Pacific northwest. The golden spike was driven by Arthur Curtiss James who controls the Western Pacific and who is reputed also to be the largest individual stockholder in the Great Northern. The celebration at Bieber was participated in by members of the boards of directors and principal officers of the Western Pacific, the Great Northern and other railways as well as by citizens of California, Nevada, Utah, Colorado, Oregon, Washington, Idaho and other states, and British Columbia. The through line was opened for freight traffic following the driving of the golden spike, while through passenger service will be inaugurated over the new line by May 1, 1932.

Railroads File Substitute For I. C. C. Plan

The railroads of the United States filed with the Interstate Commerce Commission on November 19 a plan for pooling the proceeds of the temporary freight rate increase granted them conditionally by the commission in response to their petition for a 15 per cent increase in such a manner that the fund

will be distributed in the form of loans, instead of gifts as proposed by the commission. The plan of the railroads provides for the creation of a corporate agency to be known as the Railroad Credit Corporation, which would collect and administer the funds. It would be incorporated in Delaware with administrative offices in Washington, D. C., would have 12 shares of stock of \$100 par value and would have 12 directors, five from the Eastern district, including one from New England, two from the Southern district, three from the Western district, and one named by the directors of the American Short Line Railroad Association, while a director at large would be president of the corporation. In their petition, the railroads pointed out that to treat advances from the fund to railroads in financial difficulties as loans will avoid legal difficulties that are regarded as formidable.

Motor Trucks Haul Much Fruit and Vegetables

Motor trucks are hauling approximately 15 per cent of the shipments of fresh fruits and vegetables transported 20 miles or more to markets, according to the Bureau of Agricultural Economics, United States Department of Agriculture, reporting the results of a recent survey. On a mileage basis, however, the percentage of motor truck to total shipments is much less than 15 per cent because of the much longer average haul by the railroads. The shipment of such products by trucks in 1929 amounted to from 150,000 to 200,000 car loads, as compared with 1,068,745 car loads transported by rail and boat lines, according to the survey. Motor trucks are becoming an increasingly important factor in the short-haul transportation and distribution of fruits and vegetables, according to the conclusions of the Bureau, while at the same time distances covered by trucks are increasing. Perishable products are now being hauled regularly for distances up to 400 miles, and even greater distances in some areas. Redistribution from city markets to surrounding trade territories has grown in volume and, except for local supplies, the area within 50 miles is now usually supplied with fruits and vegetables by trucks from large city markets. Cold-storage plants aid motor truck transportation by prolonging the trucking season. Canning plant managers are using trucks to obtain more soft fruits

and tomatoes of desirable maturity and to extend the area from which the supplies are received.

Railway Business Association Meets at Chicago

The Railway Business Association held its annual meeting at Chicago, on November 4, at which time a number of resolutions bearing on various aspects of the railway problem were adopted. Among other things, these resolutions congratulated the railways on the achievement of unity in presenting their recent rate case to the Interstate Commerce Commission; interpreted various parts of the Commission's decision in the rate case as indications that there is reason to hope for the financial future of the railroads; opposed every measure designed to further the Government ownership and operation of railways; declared that Congress should pass the necessary legislation to require the sale to private owners of the Federal barge line within two years; urged Congress, through restrictions upon interstate traffic by motor-bus or truck, to bring about as nearly as possible equality of opportunity for the railways as compared with highway carriers; advocated that the railways should be authorized to operate ships; and commended the action of the United States Chamber of Commerce in launching a survey of Government competition with citizens in business.

Wage Problem Receives Attention

The stabilization of railway employment and possible reductions in the wages of organized railway labor have been receiving considerable attention in recent weeks by both railway executives and the labor organizations. At the invitation of the Railway Labor Executives Association, a committee of nine railway presidents appointed from the Eastern, Western and Southern regions, and headed by Daniel Willard, president of the Baltimore & Ohio, met in New York on November 19 with labor leaders representing 21 railway organizations, to discuss these and other matters of mutual interest. At this meeting the labor representatives presented proposals for a shorter working day and the stabilization of employment in various ways, while the rail executives countered with the suggestion that the unions submit to a voluntary reduction of 10 per

cent in wages. The labor executives rejected the wage reduction proposal and the conference adjourned on November 22 without an agreement having been reached on the other questions. Following this conference a meeting of 1,500 representatives of railway labor organizations has been called in Chicago beginning December 8.

New Simmons-Boardman Officers

Following the election of Samuel O. Dunn as chairman and Henry Lee as president of the Simmons-Boardman Publishing Company, as announced in the November issue, Elmer T. Howson, editor of *Railway Engineering and Maintenance* and western editor of the *Railway Age*, has been elected vice-president and director; Fred C. Koch, business manager of *Railway Engineering and Maintenance* and manager of advertising sales of all the railway publications of the company, has been elected vice-president; Roy V. Wright, secretary of the company, has also been elected vice-president; George Slate, business manager of *Marine Engineering* and the *Boiler Maker* and a director of the company, has been elected vice-president; and Frederick H. Thompson, vice-president in charge of the Cleveland office has been named to the directorate. Walter S. Lacher, managing editor of *Railway Engineering and Maintenance* and western engineering editor of the *Railway Age*, has been promoted to engineering editor of the latter publication in addition to his position of managing editor of the former paper, taking over



Elmer T. Howson

a portion of the editorial duties formerly handled by Mr. Howson.

Elmer T. Howson was born at Follets, Iowa, on May 23, 1884, and was educated at the University of Wisconsin, from which he graduated in 1906. He entered railway service in 1903 as field draftsman for the Iowa & Illinois Railway (now the Clinton, Davenport & Muscatine). He later became an instrumentman for the same road and in 1905 went with the Chicago, Burlington & Quincy in the same capacity. From 1906

to 1909 he was a resident engineer and assistant engineer on heavy construction of the same road, and from 1909 to 1911 was division engineer.

In the latter year he joined the staff of the *Railway Age* as engineering editor, with responsibilities that included the editing of a *Maintenance of Way* section published in the third issue of each month, beginning with the issue of May 19, 1911. By June, 1916, this section was sufficiently established to warrant its publication as a separate monthly paper, the *Railway Maintenance Engineer* (now *Railway Engineering and Maintenance*), with Mr. Howson as its editor. In 1919 he was promoted also to western editor of the *Railway Age* and two years later, when the publication of the *Railway Engineering and Maintenance Encyclopedia*, was undertaken, he also became its editor.

Mr. Howson is a past president of the American Railway Bridge and Building Association, the Western Society of Engineers, the Track Supply Association and the National Conference of Business

in Company with office at New York.

Roy V. Wright was born at Red Wing, Minn., on October 8, 1876, and was graduated from the University of Minnesota with the degree of M. E. in 1898, following which he entered the service of the Chicago, Milwaukee & St. Paul as a machinist's apprentice. Two years later he became a draftsman for the Chicago Great Western and later became chief draftsman. In 1901 he was ap-



Frederick C. Koch

Paper Editors. He is now president of the Roadmasters' and Maintenance of Way Association, first vice-president of the American Wood-Preservers' Association, a member of the executive council of the American Association of Railroad Superintendents and a member of the executive committee of the Associated Business Papers, Inc. He has also served as chairman of the Illinois section of the American Society of Civil Engineers.

Frederick C. Koch was born in Jersey City, N. J., on June 9, 1893, and was educated in the public schools of New York. He entered the employ of the *Railway Age-Gazette* in 1909 in a minor capacity and rose through various clerical positions to the management of the advertising make-up department. In 1917 he became an advertising sales representative for all Simmons-Boardman transportation publications, with the title of assistant to the vice-president. In 1925 he was appointed business manager of *Railway Engineering and Maintenance* and a few months ago he was made, in addition, manager of advertising sales of the railway publication division of the Simmons-Boardman Publish-



Roy V. Wright

pointed mechanical engineer of the Pittsburgh & Lake Erie, resigning in 1904 to become associate editor of the *American Engineer and Railroad Journal* (now the *Railway Mechanical Engineer*). He was promoted to editor a year later and continued as such until 1910 when he became mechanical department editor of the *Railway Age-Gazette* (now the *Railway Age*). A year later he was advanced to managing editor, a position he still holds. Since 1912 he has been also editor of the *Railway Mechanical Engineer*. In 1915 he was elected a director of the Simmons-Boardman Publishing Company, and in 1919 also secretary.

Mr. Wright has long taken a keen interest in the Y. M. C. A., and has been especially active in administrative matters and in the promotion of its railroad department. He has taken a prominent part in engineering and railway societies and is now president of the American Society of Mechanical Engineers and a director of the New York Railroad Club, and has served two terms as president of the United Engineering Society, New York.

Frederick H. Thompson was born in Cleveland, Ohio, on August 1, 1885. He attended the Brooks School at Cleveland and the University School and Military Institute at East Orange, N. J. He started his business career as a newspaper reporter in New York in 1902 and served for a time as a dramatic critic. From 1904 to 1907 he was eastern representative of the *Music Trade Review*, becoming an advertising representative of the *American Engineer and Railroad Journal* in the latter year. He became business manager in 1910 and continued in that capacity when the name was changed to *Railway Mechanical Engineer* in 1912. He was general manager of the Sim-

mons-Boardman Publishing Company in the Central district at Cleveland, Ohio, from 1920 to 1924, since which last date he has been a vice-president of the company in charge of the Central district, with offices at Cleveland, Ohio.

Walter S. Lacher was born at Winona, Minn., on April 7, 1884, and was graduated from the University of Wisconsin in 1907. He entered railway service as a rodman on the Chicago & Alton in July, 1905, and served subsequently as an in-



Frederick H. Thompson

strumentman and field draftsman on construction. From July, 1907 to July, 1908, he was an assistant engineer in maintenance and construction on the same road, and from the latter date of January, 1909, he served as a designer of bridges for the Illinois Highway Commission. He then entered the employ of the Chicago, Milwaukee & St. Paul as an engineer draftsman in the bridge depart-



Walter S. Lacher

ment, subsequently becoming office engineer in bridge design. In May, 1915, he joined the staff of the *Railway Age* as assistant engineering editor, becoming western engineering editor a year later. In June, 1916, he was appointed also associate editor of the *Railway Maintenance Engineer*, and in 1917, was promoted to managing editor. Mr. Lacher has also been active in various railway associations. Among others, he participated in the organization of the Maintenance of Way Club of Chicago in September, 1921, of which he has since served as its secretary-treasurer.

ASSOCIATION NEWS

Maintenance of Way Club of Chicago

Seventy-nine members and guests attended a meeting on Wednesday evening, November 18. M. D. Bowen, engineer of welding and work equipment, Chicago, Milwaukee, St. Paul & Pacific, presented a detailed description of the process employed by the Milwaukee for heat-treating rail ends and reviewed the results in the way of decreased end flow and batter that had been secured.

Metropolitan Track Supervisors' Club

The next meeting of the Metropolitan Track Supervisors' Club will be held on December 17, at 12:30 p. m., at Keen's Chop House, 72 West Thirty-Sixth street, New York City. The feature of the meeting, which will follow immediately after the luncheon, will be a lecture on the new George Washington bridge over the Hudson river at New York, by Frank W. Skinner, consulting engineer, New York.

of the convention until last March.

The Nominating committee has completed the selection of the ticket for the annual election and, as soon as formal acceptances have been received from those named the ticket will be printed and sent to the members. The committees on Personnel of Committees and on Subjects have practically completed their tentative assignments for next year and these assignments will be published during the month. As the assignments now stand, there will be only one change in committee chairmanships, W. M. Vandersluis, general superintendent telegraph and signals, Illinois Central, succeeding Sidney Withington, electrical engineer, N. Y. N. H. & H., as chairman of the Committee on Electricity, which also comprises the Electrical section, Engineering division, of the American Railway Association.

Two-day meetings held by the Committee on Masonry and the Committee on Buildings at Chicago on November 5 and 6, virtually completed the work of the committees in preparation for the 1932 convention. Seventeen reports are now in the hands of the secretary and, of those which he has already turned over to the printer, the first five or six will go to the members in bulletin form within the next 10 days.

Bridge and Building Association

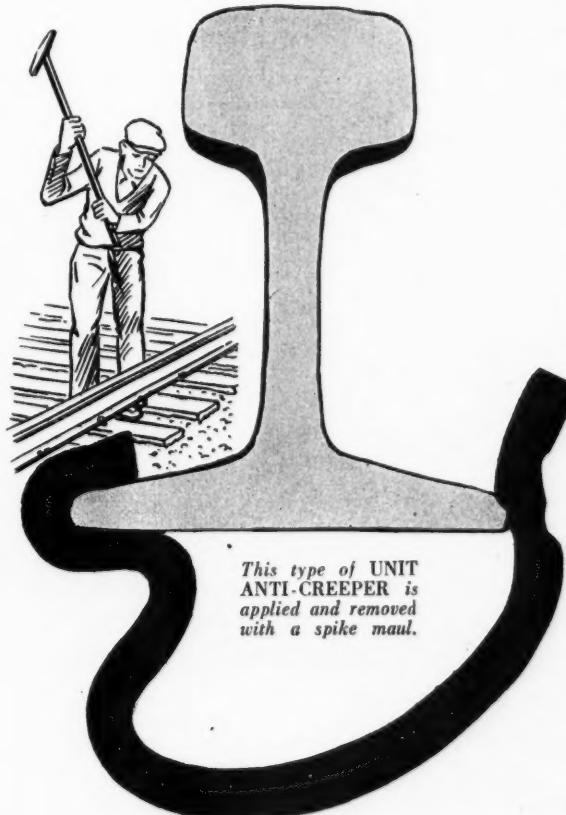
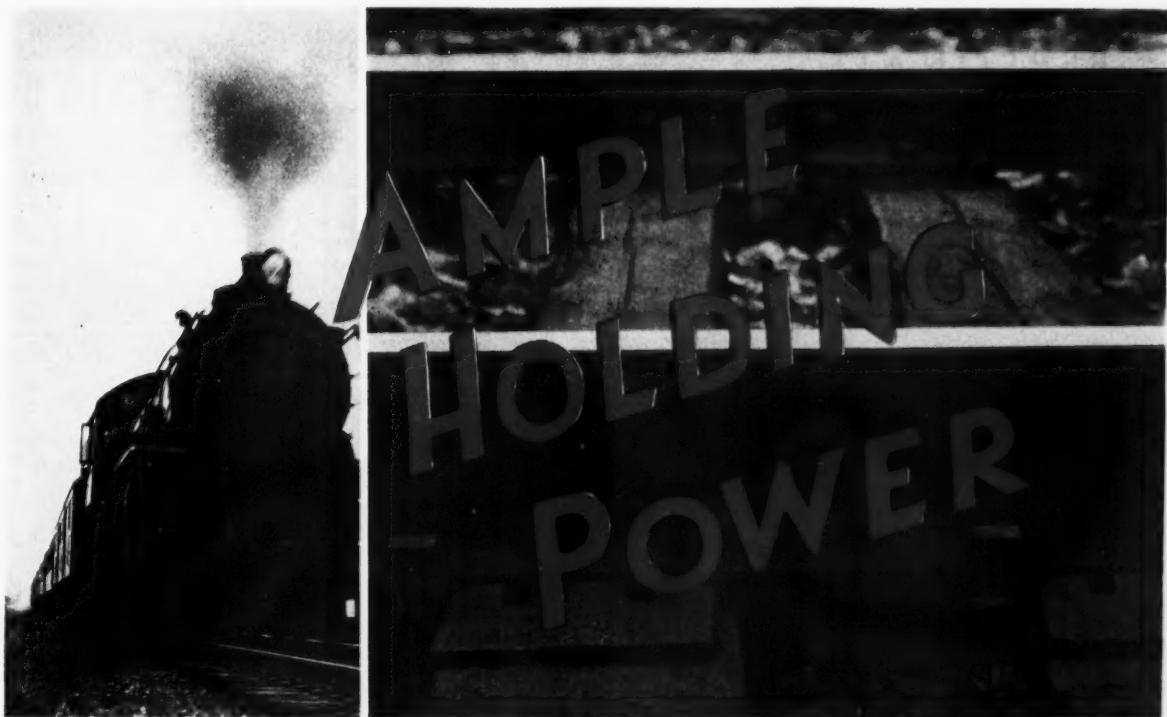
The Executive committee has authorized the publication, in *Railway Engineering and Maintenance*, of the committee reports that were to have been presented at the October, 1931, convention. Owing to the fact that this convention has been postponed a year, it was the thought of the Executive committee that the members should have the benefit of the work done by the various committees, through the publication of the reports during the year in advance of the next convention and that construction criticism which the committee chairmen might receive from the members as a result of the publication would offer an opportunity for some refinements in the reports before their final presentation at the convention in October, 1932.

Hydraulic Tables and Other Data—

The Baldwin-Southwark Corporation, Philadelphia, Pa., has recently issued its Bulletin No. 25, containing 32 pages, which is devoted exclusively to the presentation of practical information and data for the use of engineers engaged in the design or use of hydraulic equipment. Tables giving the quantity of water passed through 100-ft. lengths of clean steel pipe under various pressure differentials are said to be the first ever to present such information in printed form. The bulletin also contains data on plunger displacements, wire and sheet metal gages, the properties of bolts, specific gravities and weights, strength of materials, properties of various sections, beam formulas and moments of inertia of rectangles.

American Railway Engineering Association

Definite action with respect to the 1932 convention was taken by the Board of Direction at Chicago on November 4, when it was decided to adhere to the plan followed at the 1931 convention, namely, to hold a two-day meeting on March 15 and 16, including an evening session on March 15. Arrangements were also made for an additional feature in the form of a noonday luncheon on the second day, in lieu of the annual dinner which had been a regular feature



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PERSONAL MENTION

General

J. L. Gressitt, superintendent of the St. Louis division of the Pennsylvania, and who, until relatively recently has been connected with the engineering department of this road, has been promoted to general superintendent of the Southwestern division, with headquarters at Indianapolis, Ind. Mr. Gressitt was born on April 4, 1887, at Baltimore, Md. and was educated at the Baltimore Polytechnic Institute and at Lehigh University. He entered railway service on August 4, 1908, on the engineering corps of the Pittsburgh division of the Pennsylvania, being advanced through the positions of chainman, rodman and transitman. On May 1, 1915, he was promoted to assistant supervisor of track on the Bellwood division, later serving at Williamsport, Pa., and at Philadelphia. From October 1, 1917, to July 10, 1919, he was in military service with the 21st Engineers. After the war he returned to the Pennsylvania as acting supervisor on the Monongahela division later being promoted to supervisor, in which capacity he served during the next seven years on the Monongahela, Philadelphia Terminal and Pittsburgh divisions. He was promoted to division engineer of the Fort Wayne division on January 16, 1927, being further advanced to super-

intendent of the Sunbury division with headquarters at Sunbury, Pa., on December 1, 1929. About June 1, 1931, he was transferred to the St. Louis division, at Terre Haute, which position he retained until his recent promotion, effective November 1.



J. L. Gressitt

intendent of the Sunbury division with headquarters at Sunbury, Pa., on December 1, 1929. About June 1, 1931, he was transferred to the St. Louis division, at Terre Haute, which position he retained until his recent promotion, effective November 1.

Robert K. Rochester, general manager of the Eastern region of the Pennsylvania and formerly a division engineer on this road, has been promoted to assistant to the vice-president in charge of operation, with headquarters as before at Philadelphia, Pa. Mr. Rochester was born on December 7, 1877, at Simcoe,



Robert K. Rochester

Ont., and was educated at Rose Polytechnic Institute, Terre Haute, Ind. He entered railway service on November 10, 1901, as assistant engineer maintenance of way on the Michigan division of the Vandalia Railroad (now part of the Pennsylvania). From May 1, 1902, until November 1 of the same year, he served as acting engineer maintenance of way of the same division and then became engineer maintenance of way, which position he held until June 1, 1905. From that time until May 1, 1909, Mr. Rochester was principal assistant engineer of

been appointed engineer of construction of the Lines West of Buffalo and of the Ohio Central Lines, with headquarters at Cleveland.

C. G. Grove, division engineer of the St. Louis division of the Pennsylvania, with headquarters at Terre Haute, Ind., has been transferred to the Panhandle division, with headquarters at Pittsburgh, Pa., where he succeeds **T. E. Nestor**, who has been transferred to the Monongahela division, at Uniontown, Pa. Mr. Nestor replaces **W. S. Wilson**, who has been transferred to the Conemaugh division, with headquarters at Pittsburgh, where he relieves **A. H. Tasker**, who has been transferred to the Buffalo division, with headquarters at Buffalo, N. Y. Mr. Tasker succeeds **N. M. Lawrence**, who has been transferred to the St. Louis division, at Terre Haute, to replace Mr. Grove. **F. V. Berkey**, assistant division engineer of the Cleveland division, with headquarters at Cleveland, Ohio, has been appointed chief draftsman of that division, with headquarters at the same point and the position of assistant division engineer has been abolished.

Following the consolidation of a number of divisions on the Chicago, Milwaukee, St. Paul & Pacific and the discontinuance of the positions of district engineer, a number of changes in the personnel of the engineering department have taken place. **B. O. Johnson**, division engineer of the Sioux City & Dakota division, with headquarters at Sioux City, Iowa, has been transferred to Aberdeen, S. D., with jurisdiction over that part of the Hastings & Dakota division west of Montevideo, Minn. **H. B. Christianson**, division engineer of the Iowa division, with headquarters at Marion, Iowa, has had his jurisdiction extended to include the Des Moines division and that part of the S. C. & D. division east of McCook, S. D. **M. A. Bost**, division engineer of the Iowa & Dakota division, with headquarters at Mason City, Iowa, has had his jurisdiction extended to include that part of the S. C. & D. division west of McCook. **W. G. Powrie**, division engineer of the Iowa & Southern Minnesota division, with headquarters at Austin, Minn., has been transferred to Savanna, Ill., with jurisdiction over the Dubuque & Illinois division and the Kansas City division. **E. H. Johnson**, division engineer of the D. & I. division, has been transferred to the I. & S. M. division, at Austin, to succeed Mr. Powrie. **W. H. Vosburg**, division engineer of the Kansas City division, with headquarters at Ottumwa, Iowa, has been transferred to La Crosse, Wis., with jurisdiction over the La Crosse & River and the Wisconsin Valley divisions. **F. M. Sloane**, district engineer of the Middle district, with headquarters at Milwaukee, Wis., has been appointed division engineer of the Milwaukee Terminal, Superior and Madison divisions, with the same headquarters. **W. Lakoski**, division engineer of the Milwaukee Terminal division, has been transferred to the Milwaukee division, with head-

Engineering

R. O. Rote, chief engineer, **H. B. Reinsagen**, assistant chief engineer, and **H. W. Feno**, engineer maintenance of way, of the New York Central, Lines West of Buffalo, with headquarters at Cleveland, Ohio, have had their jurisdiction extended to include the Ohio Central Lines. **J. A. Stocker**, chief engineer of the Ohio Central Lines, with headquarters at Columbus, Ohio, has

TIGER WELD

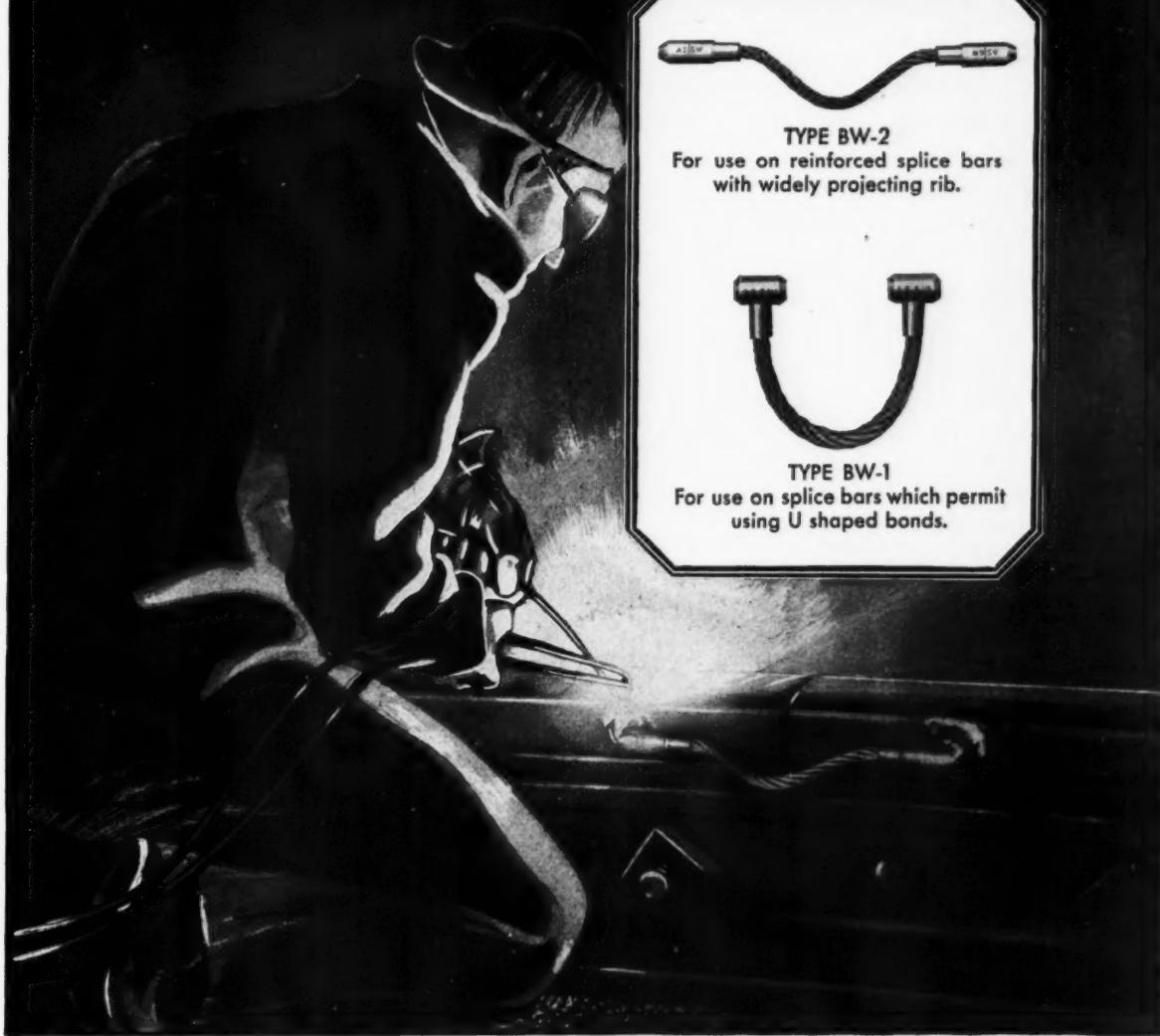


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quarters as before at Milwaukee. **A. Daniels**, district engineer of the Northern district, has been appointed division engineer with jurisdiction over the Twin City Terminals and River divisions and that part of the Hastings & Dakota division east of Montevideo, with headquarters as before at Minneapolis, Minn. **C. T. Jackson**, district engineer at Chicago, has been appointed assistant engineer maintenance of way at the same point. **G. Tornes**, general supervisor of bridges and buildings, has also been appointed assistant engineer maintenance of way, with headquarters as before at Chicago.

George F. Blackie, assistant chief engineer of the Nashville, Chattanooga & St. Louis, has been promoted to chief engineer, with headquarters as before at Nashville, Tenn., to succeed **Hunter**



George F. Blackie

McDonald, who has retired. **C. H. Johnson**, principal assistant engineer, has been promoted to assistant chief engineer with headquarters at Nashville, to succeed Mr. Blackie, and the position of principal assistant engineer has been abolished.

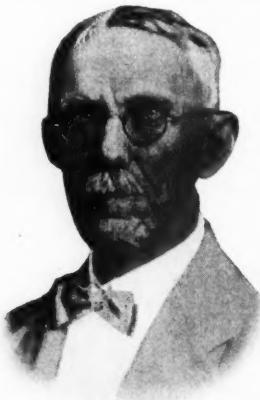
Mr. Blackie has been associated with the N. C. & St. L. almost continuously since 1886. He was born on December 22, 1869, at Nashville, Tenn., and was educated at Montgomery Bell Academy, Nashville, and at Vanderbilt University. He entered the service of the N. C. & St. L. on November 24, 1886, and served as rodman and chainman until 1888, when he left to take up his work at Vanderbilt. A year later he returned to the service of this road as a maintenance of way clerk and draftsman in the chief engineer's office. In December, 1892, he was promoted to assistant engineer, which position he held until July, 1899, when he left railway service to become superintendent of the American Phosphate Company and served in this position and as engineer of the Mt. Pleasant Southern Railroad, Mt. Pleasant, Tenn., until February, 1901. On that date he returned to the N. C. & St. L. as an assistant engineer, being promoted to engineer of roadway and track in 1914. He was further promoted to assistant chief engineer in December, 1916, which position he held continuously until

his recent appointment as chief engineer, effective November 1.

At the time of his retirement, which was also effective on November 1, Mr. McDonald had been with the N. C. & St. L. for 52 years, 39 of which were as chief engineer. He was born on June 12, 1860, at Winchester, Va., and studied engineering for a year at Washington & Lee University, Columbia, Tenn. He entered railway service in August, 1879, as an assistant engineer on the Louisville &

Engineering Association in 1904-05, and of the American Society of Civil Engineers in 1914.

With the exception of about one year, when he was on a hydro-electric development project, Mr. Johnson has been with the N. C. & St. L. continuously since 1900. He was born on August 30, 1877, at Nashville, and also received his education at Montgomery Bell Academy and at Vanderbilt University. He worked for a time as a rodman and instrumentman on the War Department project of improvement on the Cumberland river, and entered railway service in March, 1900, as a rodman on construction work with the N. C. & St. L. He served successively as transitman, resident engineer and chief of party until August, 1903, when he was transferred to maintenance work, being made engineer of construction in 1910, in charge of double-track work. On March 1, 1916, he left this road to take up contracting work as field superintendent on the construction of a dam for a hydro-electric development project on the Caney Fork river. He returned to the service of the N. C. & St. L. in October, 1917, as acting division engineer and was promoted to engineer of construction on June 1, 1919. Although Mr. Johnson's title was changed to senior assistant engineer on May 1, 1920, he continued in charge of construction work until his recent promotion to assistant chief engineer, also effective November 1.



Hunter McDonald

Nashville, leaving this road in December of the same year to join the engineering staff of the Nashville, Chattanooga & St. Louis, where he was engaged in various capacities on location, construction and maintenance work for the next 10 years. In 1889, Mr. McDonald was appointed superintendent of the Huntsville, Fayetteville & Columbia division, which position he held until 1891, when he was appointed resident engineer of the Western Atlantic (now part of the N. C. & St. L.). In 1892 he was promoted



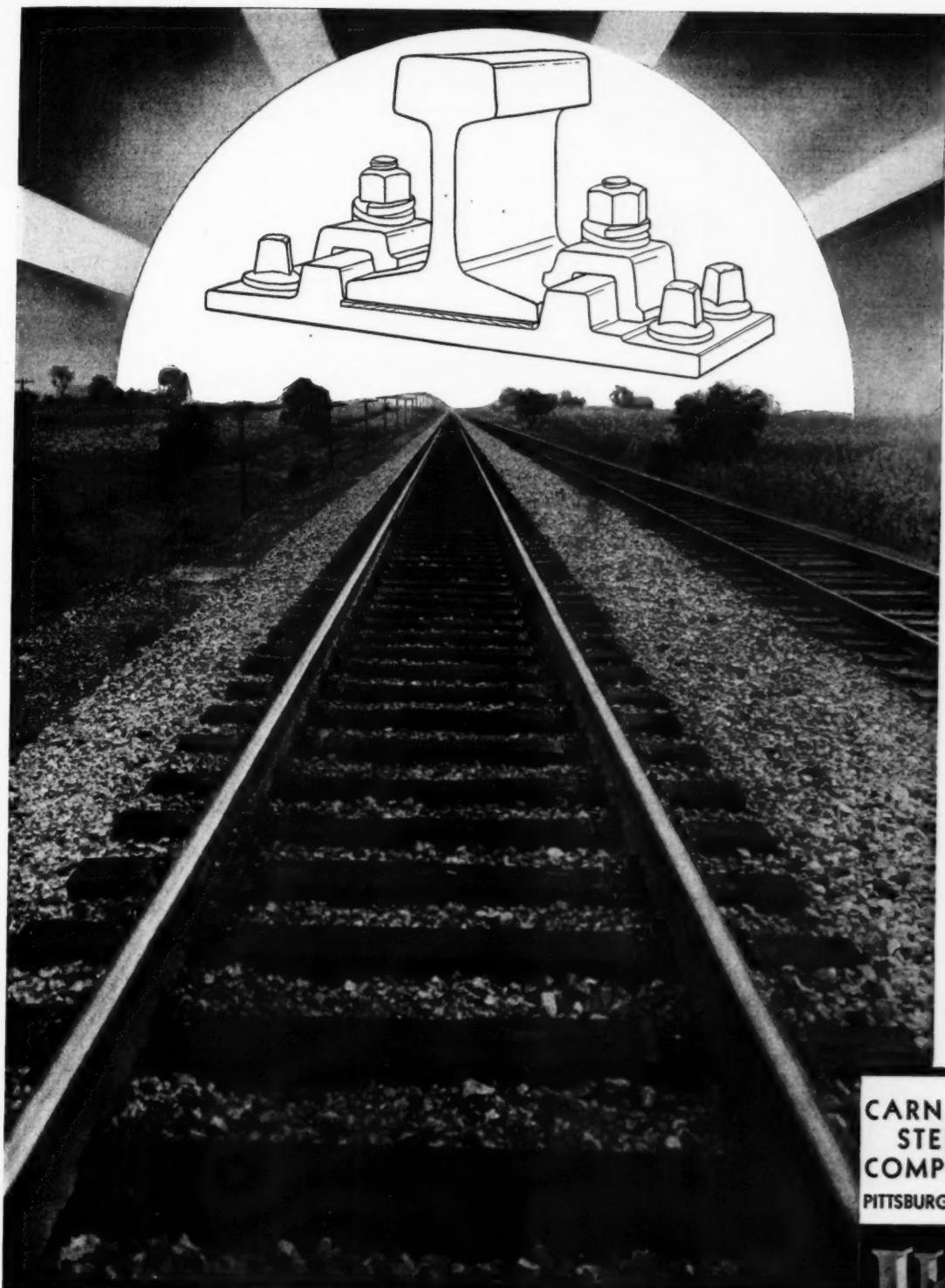
C. H. Johnson

to chief engineer of the N. C. & St. L., which position he held continuously until his retirement. From 1918 to 1920, during federal control of the railroads, Mr. McDonald was also chief engineer of the Tennessee Central and of the Birmingham & North Western. He took an active interest in the work of various engineering organizations, having been president of the American Railway En-

gineering Association in 1904-05, and of the American Society of Civil Engineers in 1914.

G. H. Harris, assistant chief engineer of the Michigan Central, has been promoted to chief engineer, with headquarters as before at Detroit, Mich., to succeed **J. F. Deimling**, who has retired. These changes became effective on November 1.

Mr. Harris has been associated with the engineering department of this road for 28 years. He was born at Toledo, Ohio, on July 17, 1878, and received his engineering education at the University of Michigan. He entered railway service in 1901 on the construction of the Detroit & Toledo Shore Line, and in 1902 he became an assistant on the engineering corps of the Pennsylvania, at Chicago. A year later Mr. Harris joined the engineering organization of the Michigan Central as an assistant engineer and has remained with this road continuously until the present. In 1905, he was promoted to division engineer, with headquarters at Niles, Mich., but was reappointed assistant engineer, with headquarters at Detroit, a year later. From 1907 to 1910, he was assistant engineer in charge of the grade separation project of the Michigan Central and the Chicago, Rock Island & Pacific at Joliet, Ill., being on the latter date promoted to division engineer on the M. C. at St. Thomas, Ont. Two years later Mr. Harris was transferred to Detroit and in 1913 he was appointed engineer of track, which position he held for three years before being advanced to engineer maintenance of way. During the period between 1917 and 1919 he was acting assistant chief engineer, being in the latter year appointed special engineer. He served as engineer



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maintenance of way in 1920-21, and was promoted to assistant chief engineer in the latter year, which position he held until his promotion to chief engineer, at Detroit.

Mr. Deimling has had a varied railway engineering career, which dates back about 45 years. He was born on November 18, 1867, and first entered railway service in March, 1886, as a rodman on the Missouri Pacific. In September of

than six years he went with the Michigan Central as engineer of construction, and in December, 1913, he was promoted to assistant chief engineer. About four years later, Mr. Deimling was appointed acting chief engineer and from May, 1919, to November, 1921, he was assistant chief engineer, being advanced to chief engineer on the latter date. He held this position continuously until his retirement.



G. H. Harris

the same year he left this road to become an assistant engineer with the W. V. McCracken Construction Company, but returned to railway service a year later as an assistant engineer on the Chicago & West Michigan (now part of the Pere Marquette). In March, 1890, he was appointed also to the same position on the Detroit & Lansing (now also part of the Pere Marquette), holding these positions until March, 1897, when



J. F. Deimling

he was appointed engineer maintenance of way of the Lake Superior & Ishpeming. He served in this position and as chief engineer of the Marquette & Southern until June, 1904, when he was made track engineer of the Pere Marquette. A year later he was appointed division engineer maintenance of way of the same road at Grand Rapids, Mich., which position he held until February, 1906, when he was promoted to chief engineer of the Pere Marquette with headquarters at Detroit, Mich. After serving in this position for more

Track

Charles W. Tyson, roadmaster on the Melville division of the Canadian National, with headquarters at Melville, Sask., has retired from active service.

W. H. Bentz, track foreman on the Chicago & North Western, with headquarters at Norfolk, Neb., has been promoted to roadmaster on the Eastern division, with headquarters at Fremont, Neb., to succeed **A. E. Benson**, who has been transferred to the Lake Shore division, with headquarters at Fond du Lac, Wis., where he replaces **P. A. Friess**, who has retired.

T. R. Conners, roadmaster of the Butte division of the Great Northern, with headquarters at Great Falls, Mont., has been appointed district roadmaster with headquarters at Helena, Mont., to succeed **A. M. Bean**, who has been assigned to other duties. **F. C. Hanneman**, roadmaster of the Spokane division, with headquarters at Spokane, Wash., has been appointed district roadmaster, with headquarters at Hillyard, Wash., succeeding **G. Anderson**, who has been transferred to Wenatchee, where he succeeds **C. Rutherford**, who has been assigned to other duties. These changes were brought about by a recent consolidation of divisions on the Great Northern, as announced in *Railway Engineering and Maintenance* for November.

B. A. West, assistant superintendent of the New Mexico division of the Atchison, Topeka & Santa Fe, with headquarters at Albuquerque, N. M., has been appointed general inspector of track, with jurisdiction over the Western Lines and the Panhandle & Santa Fe, with the same headquarters.

W. W. Marshall, district engineer of the St. Louis district of the Missouri-Kansas-Texas, with headquarters at Boonville, Mo., has been appointed roadmaster with headquarters at the same point. **R. C. Dunlay**, district engineer of the Parsons district, has also been appointed roadmaster with jurisdiction over that part of the Neosho division between Parsons, Kan., and Junction City, with headquarters as before at Parsons. **W. C. Pruitt**, district engineer of the McAlester district, with headquarters at Muskogee, Okla., has been appointed assistant general foreman with headquarters at the same point. These changes were brought about by a consolidation of district engineers' duties, as noted in *Railway Engineering and Maintenance* for November.

Bridge and Building

H. A. Ward, acting bridge and building master of the Campbellton division of the Canadian National, with headquarters at New Carlisle, Que., has been appointed bridge and building master of the same division, with headquarters at Campbellton, N. B., to succeed **E. Savage**, who has retired.

H. Bly, master carpenter of the Willmar division of the Great Northern with headquarters at Willmar, Minn., has been appointed assistant master carpenter with headquarters at Minneapolis, Minn. **E. Johnson**, master carpenter of Butte division with headquarters at Great Falls, Mont., has been assigned to other duties. These changes are in addition to those announced in the November issue, following the consolidation of several divisions.

Obituary

J. W. Powers, supervisor of track on the New York Central, with headquarters at Rochester, N. Y., died at that point on November 25.

George F. P. Day, who retired as assistant chief engineer of the Fitchburg Railroad (now a part of the Boston & Maine) in 1885, died at his home in San Diego, Calif., on November 1.

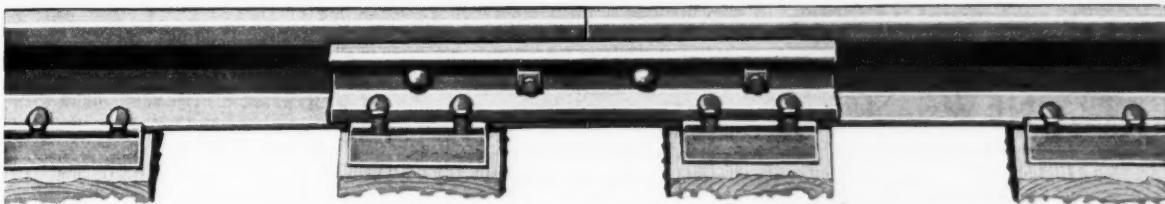
P. J. Hurlie, track supervisor on the New York, New Haven & Hartford, with headquarters at Danbury, Conn., whose death was noted in the November issue, was born on January 30, 1872, at Middletown, Conn. He received his education in the public schools of Willimantic, Conn., and entered railway service in May, 1887, with the New Haven, as a water boy. In December of that year he left the employ of the railroad, but returned in 1889 as a track laborer. In October, 1895, he was made an extra foreman, and from that date until March, 1908, he acted either in this capacity or as section foreman. In the latter month he was made general foreman, which position he held until May, 1913, when he was appointed track supervisor, which position he was holding at the time of his death on October 16.

W. H. Stedji, resident engineer on the Minneapolis, St. Paul & St. Sault Marie, with headquarters at Minneapolis, Minn., died on October 28, at that place of a cerebral hemorrhage. Mr. Stedji was born on August 14, 1882, at Stevens Point, Wis., and entered railway service with the Soo Line on April 4, 1903, as a chainman, at Alexandria, Minn. Three years later he was promoted to rodman and on May 1, 1912, he was appointed pile inspector. A year later Mr. Stedji was advanced to instrumentman, at Superior, Wis., being appointed assistant engineer at that point on October 1, 1916. He was further promoted to division engineer of the Duluth-Superior division on July 1, 1924, which position he held until May 19, 1930, when he was made resident engineer at Minneapolis.

December, 1931

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SUPPLY TRADE NEWS

General

A receiver for the **American Well Works**, Aurora, Ill., has been appointed by the Circuit Court of Kane county, Ill., following action brought by the Northern Trust Company, Chicago, as trustee for the bond holders. **Paul A. Florian**, advertising counselor, is receiver and **H. G. Chapman**, president of the company, is co-receiver. The receivership is of a friendly nature and it is expected that it will be of short duration.

Personal

Ralph W. Payne has been appointed district railroad representative in the southeastern states, with office at 613 Fifteenth street, N. W., Washington, D. C. of the **American Hoist & Derrick Company**, St. Paul Minn.

W. J. Wignall, formerly vice-president of the Locomotive Terminal Improvement Company, has been appointed director of railroad sales for the **A. M. Byers Company**, with headquarters at Pittsburgh, Pa.; **J. A. Ainsworth** is as-



W. J. Wignall

sistant to Mr. Wignall, and railroad department representation will be maintained in New York by **C. W. Damberg**, in Chicago by **F. W. Stubbs** and in Pittsburgh by **C. A. Croft**.

Mr. Wignall graduated from Armour Institute of Technology in 1920, his education having been interrupted in 1917 when he enlisted in the United States Army and served overseas in the 127th Engineers until August, 1919. Upon graduation, he became resident engineer in charge of construction for G. L. Clauzen, consulting engineer, which position he held until 1922. From the latter date until 1925, he was in the employ of the National Boiler Washing Company, holding positions of construction foreman, assistant to the vice-president in charge of purchases and sales engineer.

In 1925, he joined the Locomotive Terminal Improvement Company, serving as sales engineer and later as vice-president until his recent resignation.

A. W. Thompson, vice-president and Pacific Coast manager in charge of sales of **Fairbanks Morse & Co.**, with headquarters at San Francisco, Calif., has been elected vice-president in charge of manufacturing with headquarters at Beloit, Wis., to succeed **W. B. Heath**, resigned. Mr. Thompson graduated from Renn-



A. W. Thompson

sealaer Polytechnic Institute in 1907 and upon his graduation, became associated with the George A. Just Company, New York, and later with Westinghouse, Church, Kerr & Co., where he engaged in engineering and sales work. In 1910 he entered the employ of the General Electric Company, where he served for 10 years and was in charge of the design and development of the Erie Works of that company. In 1920 he joined the Fairbanks-Morse organization as general manager of the Indianapolis plant and in 1926, was transferred to San Francisco as Pacific Coast manager in charge of sales. In 1928 he was also made a vice-president and continued as such until November 1, 1931, when his jurisdiction was transferred to manufacturing.

H. T. Potter has been appointed merchandising and advertising director of the recently formed **Ames Baldwin Wyoming Shovel Company**, North Easton, Mass. Mr. Potter was for a long time identified with the Wyoming Shovel Works, having joined that company in 1915 and later served as its president. **E. T. Nipher** has been appointed manager of production of the Ames Baldwin Wyoming Shovel Company, and the following appointments have been made in the sales department: **Norbert T. Jacobs**, general sales manager and **C. B. Steffy**, assistant to general sales manager; **Lou Braden**, district sales manager at Pittsburgh, Pa., assisted by **L. T. Bryan**, **F. K. Tovey** and **J. T. Hughes**, in charge of New York, Pennsylvania and New Jersey territory; **H. Cunningham**, district sales manager at Parkersburg, W. Va., assisted by **S. F. Cobb**, **Robert C. Rogers**, **H. J. Ziegler**, and **Sand & Hulfish**, in

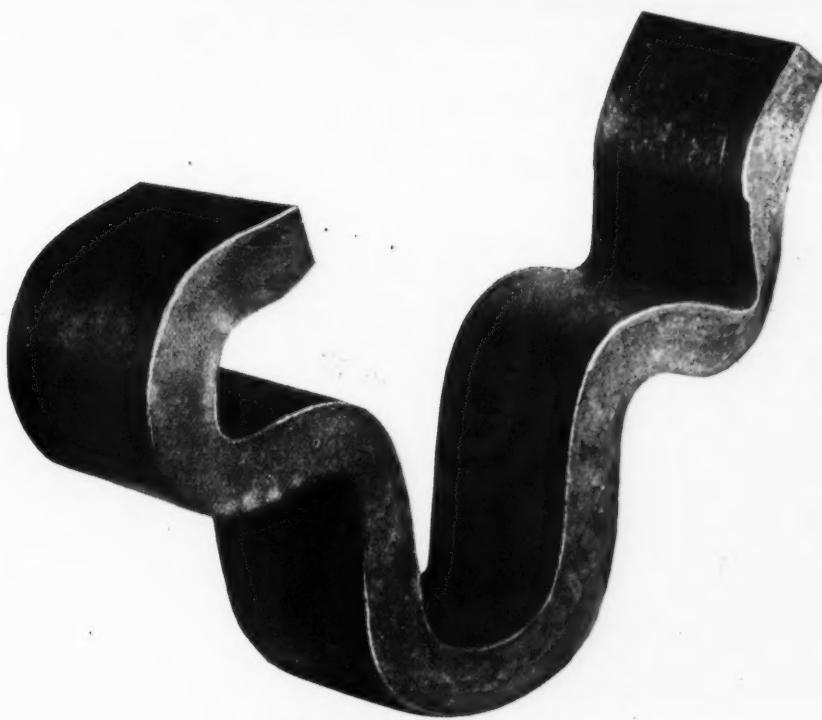
charge of Delaware, Maryland, District of Columbia, Virginia, West Virginia, North and South Carolina, Ohio, Kentucky, Indiana, Missouri and Kansas; **H. S. Bywater**, district sales manager at Chicago, assisted by **C. P. Tate**, in charge of Michigan, Illinois, Wisconsin, Minnesota, North and South Dakota, Nebraska and Iowa; **G. C. Barton**, district sales manager at New Orleans, La., assisted by **G. E. Brown**, in charge of Georgia, Florida, Alabama, Tennessee, Mississippi, Louisiana, Arkansas, Oklahoma and Texas; **H. M. Pforschich**, district sales manager at San Francisco, Calif., assisted by **G. W. Taylor**, in charge of California, Oregon, Washington, Montana, Idaho, Wyoming, Colorado, Utah, New Mexico, Arizona and Nevada.

Robert E. Keough, western representative, railway appliance division of the American Fork & Hoe Co., Cleveland, Ohio, with headquarters at Chicago, died on October 29, from a complication of ailments. Mr. Keough was born at Denver, Ill., and was educated in engineering at the University of Illinois. He entered railway service in 1892 as a trackman on the Chicago, Peoria & St. Louis.



Robert E. Keough

In 1897, he was appointed track foreman on the St. Louis, Iron Mountain & Southern at Gurden, Ark. In 1900, Mr. Keough was made extra-gang foreman on the St. Louis, Memphis & Southeastern (now the St. Louis-San Francisco). He entered the University of Illinois Academy in 1903 and continued there until 1907, doing extra-gang work on the Chicago Eastern Illinois, the St. Louis Southwestern and the Illinois Central during summer vacations. In 1907 he served as general track foreman on second track work for the Chicago, Burlington & Quincy, and in the following year he was appointed roadmaster at Hannibal, Mo., which position he held until 1910, when he was transferred to Aurora, Ill. From 1913 to 1916, he served as trainmaster and roadmaster, resigning in the latter year to become assistant engineer maintenance of way, Eastern Lines, of the Canadian Pacific, at Montreal, Que. Mr. Keough held this position until 1926, when he resigned to become western representative of the American Fork & Hoe Co.



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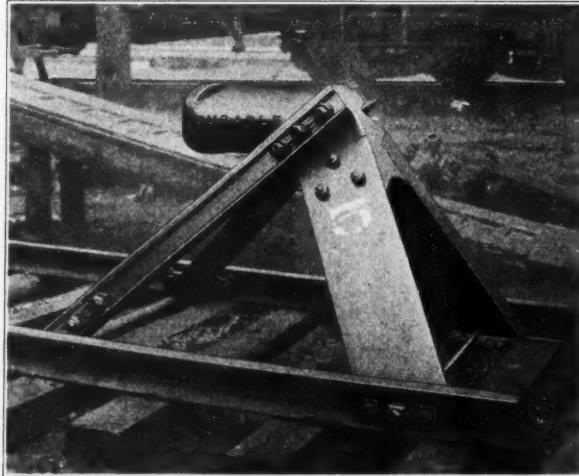
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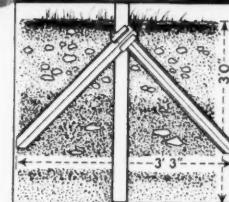
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General Offices:  Bethlehem, Pa.

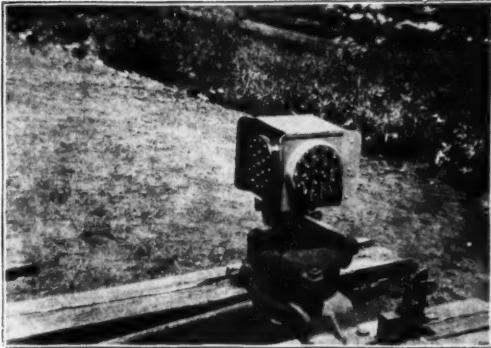
District Offices: New York, Boston, Philadelphia, Baltimore, Washington, Atlanta, Pittsburgh, Cleveland, Detroit, Cincinnati, Chicago, St. Louis.

Pacific Coast Distributor: Pacific Coast Steel Corporation, San Francisco, Portland, Los Angeles, Seattle, Honolulu.

Export Distributor: Bethlehem Steel Export Corporation, 25 Broadway, New York City.

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Do you know what it costs you per year to maintain oil lamps on your switch stands? Thousands of Dollars.



Farsighted engineers are eliminating this expense as much as possible by substituting a reflector lamp for the oil lamp. The Reflex lamp shown here was developed less than a year ago and there are now several hundred of them in service on railroads. They require no maintenance. The first cost is the last cost, and this is very reasonable. Caution and proceed signs, grade markers and other signal devices are now being equipped with Reflex lenses.

Louisville Frog, Switch & Signal Co.
Louisville, Kentucky



The name Creo-pine on creosoted southern pine is more than a trade mark. It is a pledge of honest, accurate manufacture and rigid inspection from standing tree to finished product. Back of it are 23 years of wood preserving experience.

Always Ready to Fill Rush Orders for finest grade Cross Ties

Creo-Pine
products include:

Poles
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Cross Ties
Cross Arms
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UNUSUAL treating advantages, high and dry storage yards and ample railroad facilities assist us in making prompt shipment of highest grade creosoted cross ties—pine from Georgia and Alabama, red oak from Tennessee. We can supply large or small quantities at a minimum production cost from our two plants, at East Point, Georgia, and Chattanooga, Tennessee. All ties are creosoted by the vacuum-pressure method, assuring deep and uniform penetration, long life and lowest cost per year of service. Let us know your requirements.

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Railroad Calcyanide is used by many railroads for the destruction of bedbugs, lice, fleas, cockroaches, clothes moths and other pests in camp cars, dining cars, coaches, cabooses and other railroad facilities.

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cost on the First Job**

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Let us send you our Bulletin No. 82 describing our full line of Woodworking Machines for use on the job or in the shop.

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Saw Mills and Woodworking Machinery

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Dixie Poles are cut from Dixie's own timber—clean bodied Long Leaf Yellow Pine grown on our own holdings and graded uniformly in our big sorting yard by our own inspector. Look for the Dixie Trade Mark on every stick. It guarantees 100 per cent Long Leaf Yellow Pine—and enduring service.



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CRANE . . . CLAMSHELL**

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Findlay, Ohio

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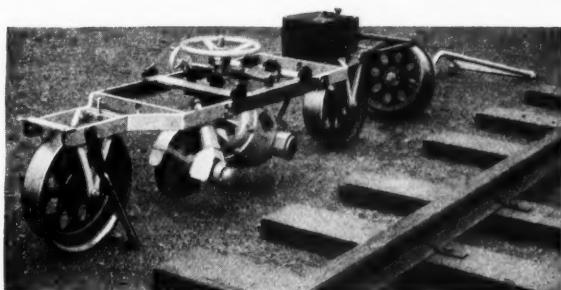
Pittsburgh-Des Moines Steel Company

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Model P-8

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Model P-3 grinds one rail joint at a time, pivots to grind the opposite rail. Electric motor powered.

Model P-2 has two grinding heads working independently on opposite rails. Electric motor powered.

Model P-4 is gasoline engine powered.

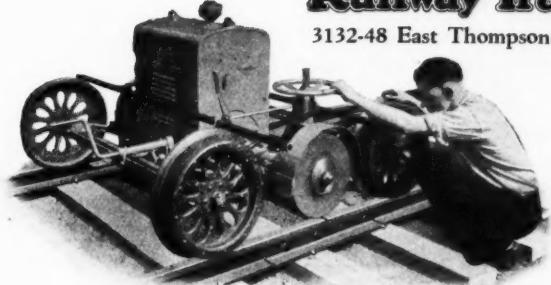
Model P-8 parks easily between adjacent tracks.

Railway Trackwork Co.

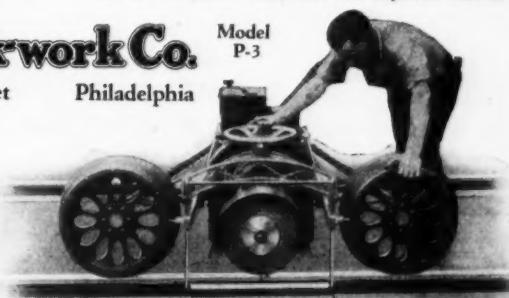
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Philadelphia

Model
P-3



Model P-4



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RAIL head wear is bound to be excessive unless outer curve rails are lubricated. Apply Mexican Graphite Curve Grease to these rails—friction stops at once—flange wear is reduced—trains move easier—and expensive steel lasts three to nine times longer!

Because of the finely divided graphite it contains, Mexican Graphite Grease provides perfect lubrication long after the grease itself has disappeared—maximum lubrication is insured at minimum cost.

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SAVES RAILS - REDUCES FLANGE WEAR



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Manganese	Works	Spikes Pullers	Worthington Pump & Ma-
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Markers	Woodings-Verona Tool	Woodings-Verona Tool	
Mansey Concrete Products	Works	Works	
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Pettibone Mulliken Co.	Louisville, Frog, Switch &	Standpipes	O. & C. Co.
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Timken Roller Bearing Co.	Rail Expanders	O. & C. Co.	
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Fairbanks, Morse & Co.	Rail Layers	Bucyrus-Erie Co.	Tongue Switches
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	Signal Co.	chinery Co.	Anchor Post Fence Co.
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	Co.	Carnegie Steel Co.	See Preservation, Timber
		Ties, Treated	Wood Working Machinery
		Curtin-Howe Corp.	Americas Saw Mill Ma-
		Southern Wood Preserving	chinery Co.
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Inspection Shows Excellent Condition



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The covering consists of NO-OX-ID "G" over which was tightly wound NO-OX-ID-IZED Wrapper. The finishing coat over the wrapper was NO-OX-ID Filler Red, which is a tough elastic semi-drying material that can be applied cold.

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NO-OX-ID
IRON-OX-RUST
The Original Rust Preventive



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D

Dearborn Chemical Co.	1089
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F

Fairmont Railway Motors, Inc.	1014-1015
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G

Gohi Culvert Mfrs., Inc.	1029
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I

Illinois Steel Co.	1077
Ingersoll-Rand Co.	1030

J

Jackson Lumber Co.	1085
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L

Louisville Frog, Switch & Signal Co.	1083
Lundie Engineering Corp.	1013

M

Magor Car Corp.	1089
Mechanical Mfg. Co.	1080
Morrison Railway Supply Corp.	1026

N

National Lead Co.	1031
National Lock Washer Co.	1011-1091
Nordberg Mfg. Co.	1023
Northwest Engineering Co.	1017

O

Oxweld Railroad Service Corp.	1018
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P

Pittsburgh-Des Moines Steel Co.	1085
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R

Rail Joint Co.	1024
Railway Trackwork Co.	1087
Ramapo Ajax Corp.	1036
Reliance Mfg. Co.	1012-1081-1082
Ruby Railway Equipment Co.	1034

S

Southern Wood Preserving Co.	1084
Southwark Foundry & Machine Co. Div.	1028
Syntron Co.	1016

T

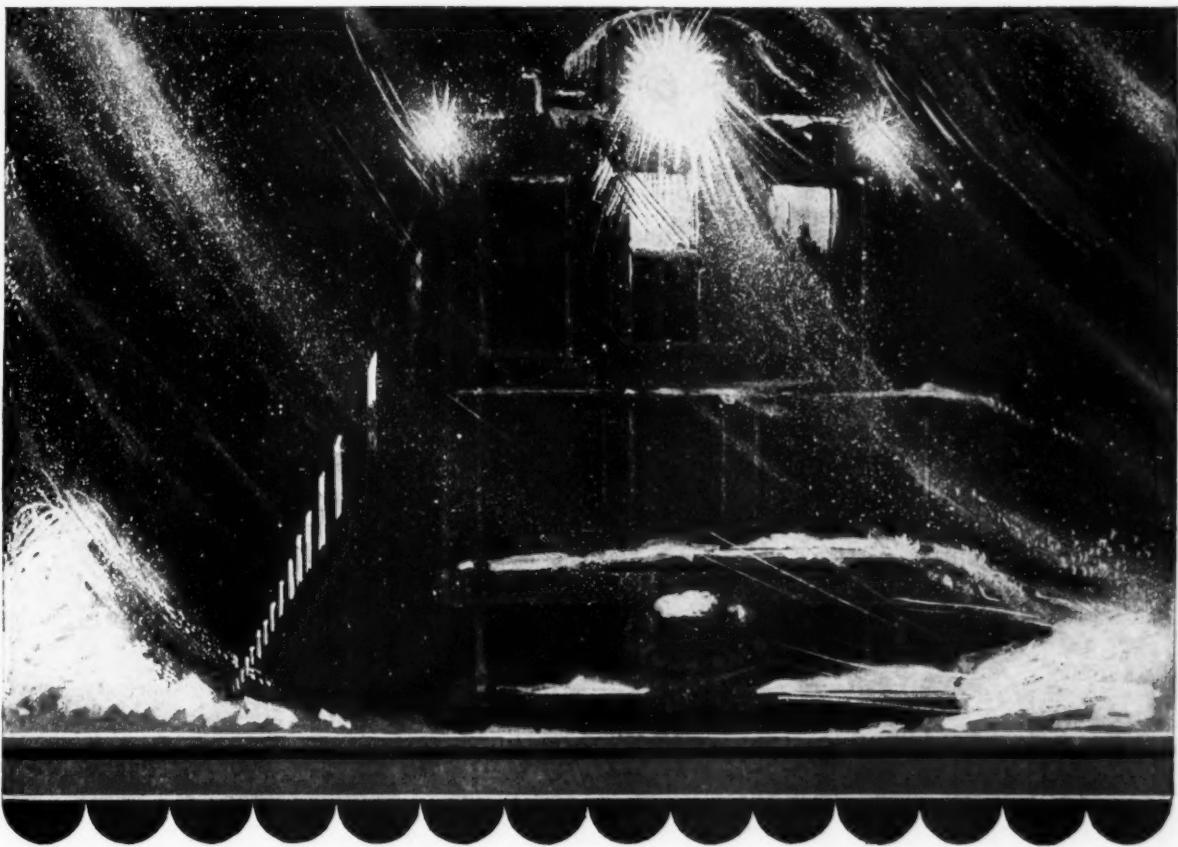
Timken Roller Bearing Co.	1092
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U

U. S. Graphite Co.	1087
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W

Western Wheeled Scraper Co.	1033
Woodings Forge & Tool Co.	1079
Woodings-Verona Tool Works.	1020-1025



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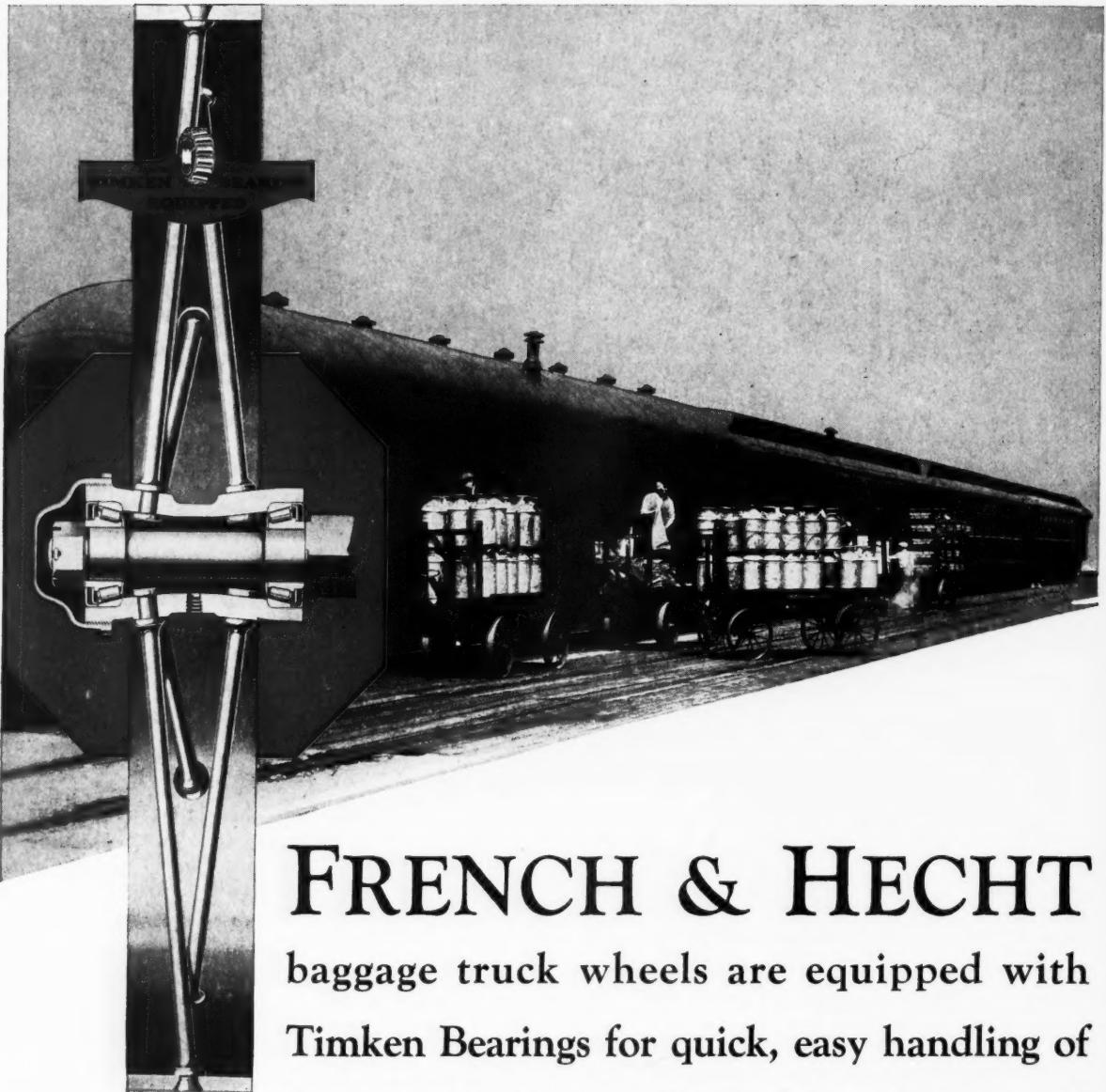
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